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THE PRACTICAL TEACHER

Mr. JOHN MUDIE.

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OF THE

NOVEMBER NUMBER

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THE DEEPENING OF THE GEOGRAPHY SYLLABUS.

BY J. F. UNSTEAD, M.A., F.R.G.S.,

Lecturer in Geography, Goldsmiths' College, University of London.

THE revision of educational curricula has recently brought about the "Widening of the History Syllabus," with which Professor Adamson dealt in the last number of this journal. It was there pointed out that the syllabus has been enlarged to include more than the history of one's own country, and that one reason for this is the intimate connection—the causal connection—between this history and the world-wide movements in which other nations share. Hence the consideration of *causes* in history has led to the extension of the syllabus.

Recent advances in the teaching of geography have had a similar origin, but the resulting change in the syllabus has been of a different character. When the *causes* of geographical facts were taken into account it seldom became necessary to enter new fields of study, but it did become necessary to cultivate the old fields thoroughly and systematically. In other words, the geography syllabus did not embrace new regions or subjects, but it required a careful study instead of a mere introduction or repetition of words and phrases. The geography lesson still deals with mountains, climate, plants, and men, for instance, but it deals with them in a different manner; it does not now consider only their distribution, but also the reasons for their distribution and the character and results of their relations to one another.

It is scarcely necessary here to give examples of the new method of treating the old matter; this was done by the present writer in this journal in December 1905, and also in a study of Palestine in the September and October numbers of this year. It may suffice to quote that excellent definition given in the *Suggestions to Teachers:* "Geography is concerned with the earth's surface, the condition of its various parts, their relations to one another, and the influence of those conditions and relations on plant life, on animal life, and specially on human life."

The question of constructing a syllabus on the new lines—that is to say, the problem of arranging the subject-matter in the best order for teaching, and apportioning it to the successive years of the school life—was considered in the January number; also the schemes suggested by the Board of Education, for elementary and secondary schools respectively, have been discussed within the last twelve months by several writers.

This paper will deal with the selection of the details of the subject matter, and the relation of the revised syllabus to education, and to school work in general.

The Change in Subject-matter.

Although the larger divisions of the subject-matter of geography are represented both in the older and the newer syllabus, yet there are considerable changes in those smaller portions of the subject-matter which comprise the larger divisions. The inclusion or omission of facts is now determined by the answer to the question whether the facts show the reasons for the distribution of various phenomena over the earth's surface or the causal connections between the phenomena. Some facts used to be omitted which have now to be included because they form links in a chain of causes. On the other hand, many facts that used to be introduced may now be omitted as standing apart from the rest of the subject-matter.

Astronomical geography is a branch of the subject which will furnish some illustrations. In considering what portions of this should be introduced, the question should be asked: What facts of astronomical geography bear upon and determine the distribution

of phenomena on the earth's surface? What astronomical facts, for example, influence the distribution of light and heat, the courses of winds and ocean currents?

After applying these tests, such matters as the names, sizes, and positions of the planets other than the earth would be omitted, for they have no appreciable bearing upon our subject even in an advanced course, and should have no place even in an advanced geography book. The phases of the moon might be introduced only to aid in teaching the causes of the tides. Correlation of full moon and new moon with spring tides is instructive, and the tides, of course, come within the purview of the geographer. Otherwise, it is difficult to see the value of teaching the phases of the moon in a geography lesson; it is properly a part of astronomy, and whether such astronomy should be taught in schools — possibly as "Nature Study" — is another question altogether. Again, it is not apparent why comets and the path of comets should be introduced into a geography course, even a "physical geography" course. Pruning of this kind is very necessary, especially as new facts have to be introduced into the syllabus in other parts.

An Important Basal Fact and its Correlations.

One fact of astronomical geography of primary importance has frequently been omitted or passed over with brief reference, viz. the swing of the belt of vertical insolation. The sun is vertically overhead at noon at the equator in March, at latitude 23½° north three months later, at the equator again in another three months, and at latitude 23½° south three months later still. As the earth rotates, a belt of the earth comes under the overhead sun and receives vertical rays, and this is called the belt of vertical insolation. Hence this belt of vertical insolation coincides with the equator in March, moves gradually northward for three months till it coincides with the Tropic of Cancer in June, then moves southward and coincides again with the equator in September, proceeds still further southward till it coincides with the Tropic of Capricorn in December, and then turns northward, reaching the equator once more in March.

This idea of a belt of vertical insolation, swinging alternately northward and southward, may have been implied in books and lessons, but it should be explicitly stated and thoroughly emphasized, for so much of the climatic geography depends upon it. For example, immediately connected with it are (1) the swing of the belt of greatest heat—the "Heat Equator," (2) the swing of the Doldrums or equatorial calms, where the air merely rises upward, and (3) the swing of the equatorial rainy region dependent upon the ascent of the air. Further, the trade winds swing northward and southward in harmony with the swing of the belt of vertical insolation, for they blow into the region of the Doldrums on either side, and the trade winds are characterised by an absence of rain.

Thus one is led to the notion of a northward and southward swing of the rain and of the drought, and this again leads to the understanding of another matter of great importance which has frequently been passed over without notice. When the heat belt swings northward—*e.g.* into the Sudan—it brings with it the rain, and therefore this region has rain with the heat—that is, in its summer time; when the belt swings southward again the trade winds also swing southward and bring dry weather to the region. Hence the Sudan has a rainy season in its summer and dry weather for the remainder of the year. On the contrary, from similar causes which there is not space to detail here, the Mediterranean region has its only rain in the cold or winter season. The difference between the vegetation of these two regions is great; for the wet season is necessarily the growing time for plants, and whether this occurs in the hot or the cold weather, of course affects the kind of plants that can grow, and also the time of the harvest. A syllabus therefore should include a study not only of the amount of rain received by different regions of the world, but also the season or seasons at which the rain falls. Without this, indeed, the plant geography and much of the economic geography is unintelligible. The "seasonal distribution of rain" has therefore found its way, or perhaps one should say, forced its way into the newer and better books, for without it teachers found that a link was missing when they attempted to show the causal connection between climate and productions.

A Change in Emphasis.

Another instance of a change in subject-matter is found in the emphasis given to certain facts of the relief of the land surface. The position and altitude of the highest peaks of a range are of comparatively little importance; it would not affect the geography much if they were considerably higher or considerably lower; therefore their exact positions and altitudes are useless, and even approximate altitudes are of little value. On the other hand, the position and heights of the passes—that is to say, of the lowest points of a range—are of great importance. Their position must be known, for communication will take place over them, and so the direction of trade-routes and the situation of trade-centres are affected by their location. To know their height is also important, for on that depends in part their usefulness, and the less the height the greater the importance. The highest points of ranges, therefore, frequently may be left out or passed over lightly, and the lowest points given the premier place.

There is no syllabus to which teachers may refer including all the requisite matter and omitting all that is unnecessary; each teacher must make this selection for himself. The inclusion or omission depends chiefly upon whether the facts or ideas are necessary parts in the complete scheme and essential links in chains of reasoning, and therefore to select wisely, teachers must first thoroughly master the principles of geography, *i.e.* the methods of interaction between phenomena, and be able to trace out causes and effects with facility. At present many teachers have not had a training which gives them this mastery. Therefore a short course of reading is now suggested with this object in view; special reading will also be needed to teach efficiently special portions of the subject.

A Preparatory Course of Reading.

As the astronomical and physical portions of geography form the basis of the rest of the work, they must be studied first, and should receive considerable attention. Hence a book on physical geography demands first place. American geographers have worked with remarkable success in this field, and

several excellent books by them are available. Among them may be specially noted the *Elementary Physical Geography* of Professor Davis, and the *New Physical Geography* of Professor Tarr. Perhaps the best English books are *Outlines of Physiography*, by Dr. Herbertson, and *The Realm of Nature*, by Dr. Mill. These books, however, are written primarily as text-books of that remarkable *omnium gatherum* known as "Physiography," and although they explain the principles of physical geography, yet their outlook is wider than that of the geographer.

The influence of physical conditions upon living creatures, and especially upon mankind, forms the second part of the subject, and is excellently set out in Dr. Herbertson's *Man and his Work*. This shows how climate and land surface affect the distribution of plant life, so that the world may be divided into several well-marked vegetation regions, each of which offers to men certain possibilities of working and living. Then the characteristics and habits of men in these regions are described, and the different forms of work—agricultural, mining, manufacturing, and commercial—are shown as related to geographical conditions. A fuller discussion of the conditions necessary for the production and transportation of the various kinds of goods is to be found in the first part of Mr. Chisholm's *Handbook of Commercial Geography*.

Having learnt the general principles of geography, the student might apply and extend his knowledge by considering separate regions, each one from all points of view, *e.g.* physical, biological, industrial, and commercial. Our own country is well treated in an elementary manner in Miss Reynolds' *British Isles*, and Mr. Mackinder's *Britain and the British Seas* is a masterly and advanced study in regional geography. The various regions of the world are dealt with by different authors in Dr. Mill's *International Geography*, and among its many valuable articles those by Professor Davis on "North America" and "The United States" are noteworthy.

Geographical Principles and Geographical Facts.

Just as the teacher needs to understand clearly the principles of geography—the ways in which the different phenomena affect one another—so he needs to set these principles clearly before his pupils, and this suggests another aspect of the selection of subject-matter. The teacher should decide first upon the principles he wishes to teach, and then teach them, not in an abstract manner, but by means of actual examples. This will insure that the important *facts* of geography receive attention, for the really important facts are those which affect others, and so exemplify the methods of interaction. The facts which do not well illustrate the principles are at the same time unimportant, and should not be included in the syllabus. The effect of applying this method of selection will be to exclude many details frequently included hitherto.

Thus, in dealing with the towns of a region, those towns which strikingly illustrate how the meeting of easy lines of communication give a favourable position for the growth of a commercial centre will be included, and these are, of course, the large towns of the region. The smaller towns are not so favourably situated, do not present such good examples, and will be omitted unless they have some other claim to attention, such as, *e.g.* a strategic position causing them to be a scene of actual or possible warfare. As more details may be learnt in regard to one's own country than in regard to foreign countries, it may be possible to include the towns of the home-land which illustrate one such principle, while, in the case of other lands, only those towns which illustrate at least two principles need be learnt. Paris may be cited as an example; it is in a favourable situation for trade, being almost in the centre of a river system composed of a number of converging streams; also it is an example of a great political capital, arising out of the chief city of a small state which has grown and absorbed its neighbours until it has become a great world-power. Paris therefore illustrates both the growth of a commercial city and also the rise of a political capital, and indeed owes its present importance mainly to these two factors in its development.

An American Selection of Cities.

In the American *Journal of Geography* there appeared recently the result of an interesting examination of the views of six of the leading teachers of geography in America. These were asked to vote upon the inclusion or omission of names in a list of the principal cities of the world. All six voted for the following cities of the United States:—New York, Chicago, Philadelphia, St. Louis, Boston, Washington, Denver, Minneapolis-St. Paul (considered as one large centre of population), Pittsburg, San Francisco, and New Orleans. Thus only eleven cities were unanimously agreed upon, and only three others received more than half the votes. In judging the decision one has to bear in mind that these teachers would not be likely to under-rate the relative importance of this subject, and that they were dealing with their own country—a country nearly as big as all Europe. In the case of other countries remarkably few places were selected. In Canada, only Montreal received six votes; Quebec was the only other city considered at all, but was not finally included as it received but five votes. The British Isles were represented by London, Liverpool-Manchester (as one large centre), Edinburgh, and Glasgow. France was represented by Paris and Marseilles, and Germany by Berlin and Hamburg. This list may appear meagre, but the treatment may be and should be thorough. The cities, their characteristics and positions should be studied, and not merely learnt by rote, and from the point of view of mental training this method is commendable.

The Value of the Teaching.

Objection will doubtless be raised on the ground that the actual knowledge of geographical facts is too limited; but the aim of the teacher who adopts this method will be not merely to teach certain facts, but also to teach the pupils how to use facts intelligently, and how and where to get fresh facts to supplement his own store. Knowing how to use a gazetteer and an atlas, knowing also how to read a map and see the many things which a good map can teach the trained mind, the lad who needs knowledge about one of the smaller towns can get it readily, and can apply the facts given in the gazetteer or atlas intelligently to the matter he has in mind.

The question is part of the larger question of the position of this kind of geography in education as a whole. Upon what grounds may the new geography

base its claim to a place in the school curriculum, and what relation does it bear to the other subjects of instruction? One may consider, in the first place, the knowledge it imparts, and in the second place the mental training it involves.

The Dynamic Conception of the World.

The geography teaching should lead the pupil to a knowledge of the world around him, both within the sphere of his own observation and beyond it, and the distinctive feature of the new geography is that this world is regarded as one vast organism, the different parts of which are constantly affecting one another. The older methods seemed to regard the world as a collection of phenomena that just "happened"; here were rivers, there mountain-ridges, here towns, there fields, and so forth, almost as though they chanced to be there at the beginning of things, and would remain to the end; there was very little recognition of the essential unity of all these phenomena and their constant change and development. In short, the old static conception has now been replaced by a dynamic conception of things. This is an important change, and to have obtained this view of the world is to have learnt a great deal. It is worth while to sacrifice many details in order to obtain this general knowledge of the world in which we live, and by which our industries, and even our characters and destinies, are affected.

The special knowledge of the situation of countries, towns, or villages may be of value to lads entering professions connected with shipping, railway, or postal work. The special knowledge of the productions and trade of various countries may be of value to lads entering merchants' offices. The special knowledge of winds and storms, ocean-currents and harbours may be of value to those about to follow the sea as a profession. Yet it is not the business of the ordinary school to cater for these special needs; its business is to give a general knowledge which may serve as a sure basis of later special training, perhaps best to be obtained in the office or upon the sea itself. Moreover, and chiefly, that wide and dynamic conception of an intricate, changing world, is one needed by every lad who is to work intelligently in the world in any capacity whatever.

An Aid to History.

The world is frequently referred to as the stage upon which the dramas of history are played, but the simile ignores the fact that the dramas of history have been profoundly influenced by, and in part have been due to, this stage itself. The study of the world enables us to understand the local setting of historical events, and also to understand in part their causes. Geography, therefore, aids history in giving the stage or setting, and in helping to trace the causes of the events studied. Again, the new geography is manifestly more efficient in this than was the old. This has been felt so strongly that sometimes geography has been included with the history as one subject, in which the geographical part has taken a very subordinate position. If the geography is treated as a mere handmaid of history it cannot be taught effectively, and even the aim of such a syllabus will be defeated, for the so-called geography necessarily degenerates into a few facts regarding the localities concerned in the history. It seems impossible to draw up a joint syllabus; the two subjects may be correlated, and may help one another greatly, but the construction of each syllabus must be carried out in accordance with the needs of each subject.

The Relation to Other Subjects.

The same is true of the correlation of geography with other subjects, such as the natural sciences. Geography must be taught independently, but not without reference to its meeting-places with other branches of knowledge. Part of the geography, for example, is dependent upon geology; but that is no reason for cutting "Physical Geography" off from the "Political Geography," and tacking it on to geology. This however is sometimes done, and may be regarded as a survival of the time when "Political Geography" was a farrago of meaningless names, and the necessary unity of the subject was not realised. The same arrangement of including physical geography in the geological syllabus is to be found in some University teaching, and in that case it would be charitable to regard it as a step in the recognition of geography as a science worthy of definite study, and so it may be looked upon as a stage in the development, at present imperfect, of a reasoned and reasonable system of education.

Another reason for the inclusion of geography in the curriculum is that it helps to show the applications of other sciences and their relation to one another. Thus it helps to show the value of the study of geology when it teaches the effect of geological structure upon the mineral resources, and therefore the manufacturing possibilities of a country. Again, it shows how the science of astronomy is connected with the art of navigation, when it deals with the problem of finding the latitude of a given place. Still again, in tracing and exemplifying the effect of climate upon the growth of plants, geography shows how the science of botany is connected with that of meteorology. From this point of view geography may crown the study of these various sciences, and conversely, it may form an introduction to them if they are taken up later in life. With a perception of whither the sciences tend, their study will at least be more attractive and probably easier.

The Mental Training.

Turning from the knowledge that is imparted by geographical teaching to consider the mental training that ensues, it seems obvious that the newer methods have a decided advantage over the old. Perhaps one can best realise the advance which has been made if one refers back to the year 1879. At that time the ideas of geography being a science, and of tracing systematically the causal connections between its phenomena, seemed practically non-existent, for even so enlightened an educationalist as Dr. Fitch then spoke as follows: "In geography there is no sequence at all. Except by accident or association, there is no one topographical fact which is more important than any other, or which can claim to be learned earlier. . . . Remember that this is the one subject in which you are least bound to preserve any predetermined order, and in which miscellaneous lessons, provided they are vivid and interesting, are quite legitimate, and serve the intended purpose well." It is only natural that with this view of the subject the lecture proceeded: "Geography is a good type of that class of subject which has its chief value as information useful in itself, and which

has comparatively few ramifications into other regions of acquirement or of intellectual life." At the present day one is inclined to think that of all subjects, geography is perhaps the most closely connected with the others; indeed, it is frequently called a "correlative science," and even abused as a mere mixture of portions of other branches of knowledge.

Similarly in considering the mental training, Dr. Fitch said: "Our main object in teaching geography is to have certain facts known, because those facts, however learned, have a value of their own. . . . The incidental and indirect effect of teaching on the formation of mental habits is not to be disregarded; and though much of the result we hope to gain belongs to the region of the memory only, we shall be all the better for inquiring whether there is not also room here for appeal to the judgment and to the imagination." The result of this inquiry is summed up as follows: "We have had before us *Descriptive* Geography, which aims at helping learners to realise the aspects of nature; *Commercial* Geography, which concerns itself with manufactures and cities, with populations and productions; and *Physical* Geography, which seeks for the truths and general laws underlying these mundane phenomena. The first addresses itself to the imagination, and is the most interesting and attractive. The second appeals to the memory, and is the most serviceable in the intercourse of life. The third alone enlists the aid of the understanding, and is for this reason the most valuable as a part of disciplinal education—the only branch of the subject which deserves to rank as science. We are to keep these three forms of geographical teaching separately in view, and to take care that each receives the consideration which is due to it and no more." It is only fair to Dr. Fitch to add that other portions of his lecture give a somewhat different impression, and that, after the modern idea of the nature of geography had been recognised, he adopted a very different attitude in regard to the subject. These extracts have been introduced only to show by contrast the value of the modern methods.

Memory and the Reason.

Whereas the acquirement of facts and the consequent exercise of the memory were then put in the forefront, we are now inclined to put them last. The facts will be acquired and the memory must be exercised, but these are now in the position of necessary results rather than definite aims. Again, whereas the training of the reasoning power scarcely received any notice, we now think it should be the chief aim. As geography is largely concerned with the tracing of cause and effect, reasoning as to causes and effects must be constantly employed.

If "Physical Geography" is to "enlist the aid of the understanding"—by which one imagines the faculty of reasoning is meant—surely the "Commercial Geography" should do so no less. For if there are causes for physical phenomena there are causes for commercial phenomena. "Manufactures and cities, population and productions" should *not* be made matters of the memory but matters of the understanding. "What are the reasons why certain manufactures have been concentrated in certain areas? Why are cities placed where they are? What factors have caused a population greatly to increase? Why are certain productions characteristic of one region and other productions characteristic of other regions." These questions suggest the form that the teaching of commercial geography should take, in contradistinction to the statement of manufactures, the repetition of the names of cities, the statistics of population, and the lists of productions which formed the basis of the geography lessons of the past.

The Imagination.

But if, in the old days, the worst teachers crammed their scholars with lists, names, and figures, the better teachers even then appealed to the imagination. All along, therefore, the training of the imagination might have been claimed, and claimed in every aspect of the work. Why should not "Commercial Geography" have a share in this? Why should not the pupils picture to themselves the life of a great manufacturing and trading city—the crowded streets; the great factories with their rows of employees, the hum of machinery, the carts or railway trucks bringing in the raw material and taking away the finished products; the docks with their shipping and their warehouses; the constantly hurried and bustling life of the workers? Or why should they not realise the conditions of the growing of wheat, let us say, in Canada—the great snow-covered fields of winter-time; the few people living there at that season; the rapid coming of spring; the awakening of life and activity; the growth of the wheat and its change of colour; the anxious watching of the weather especially towards harvest-time; the dread of insect pests; the influx of labourers; the strenuous work of harvesting and threshing during the whole of the long autumn day; the cartage of the wheat to the railway; its carriage in the great trucks and storage in the giant elevators; its ocean transport and milling; and its arrival in Europe and distribution to the bakers?

By calling up mental pictures of this kind the imagination may be trained, if only the teacher remembers that he has to teach about *things*, not *words*. The summaries of the geography books are, as it were, skeletons, and the teacher must try to clothe them with flesh and blood and impart to them the breath of life. Of course, the teacher may adopt many devices and enlist many aids. Verbal descriptions may be supplemented by maps and pictures; newspaper cuttings and sketches are useful; the stereoscope and magic-lantern may find a place.

Observation.

For a considerable number of years teachers have made children observe for themselves in some of the geography lessons, but until recently the field of personal observation seemed very limited, and especially so in the case of town children. Country children are better off in this respect, inasmuch as they can more easily see examples of physical geography—they can trace a stream along its course, and see it cutting its valley in one part, building up sand-bars and creating miniature lagoons in another part, here forming a small waterfall and there receiving a tributary. In many parts of England they can find what kind of earth underlies the thin surface layer in one part of their neighbourhood, and contrast it with that found at a little distance; this difference in geological structure can be correlated with differences in elevation

of the land surface, with differences in the trees and plants, or with differences in the uses made of the land by man. Yet the town children are better situated for learning about the industrial and commercial parts of the geography. They may learn of the work of a factory and inquire as to the advantages of its position, or watch the ships coming to a port and notice what they bring and whence they come. And town and country children alike can observe and record the weather and its changes—a very useful piece of work.

Maps, too, may be employed to lead children to see things and reason from their observations. It is neither necessary nor desirable for a teacher to state the facts shown on a map; it is much better to place the map before the children, and by questions to elicit the facts from them. With an orographical map they may be asked where large towns might grow up, and with additional information supplied by the teacher as the lesson proceeds, they may find out the most important positions and their special advantages, and learn for themselves nearly everything about the towns except the names.

Since geography cannot be made the subject of experiments as natural science can, the heuristic method is not capable of such extensive application in this subject, but much more can be done in this direction than is usually attempted. For example, to teach the exports of a country, it is easy and profitable to adopt the following plan. First the children find the articles which the natural resources of the country allow men to produce cheaply and in large quantities; then they compare these products with the needs of the people of the country, and so deduce those goods of which large amounts can be sent abroad. Next the teacher supplies a list of the exports, with their values expressed in round numbers, such as millions of pounds sterling. The children draw diagrams representing each class of goods by a rectangle, whose size is proportional to the value of the goods, and in this way the figures become of value, for the comparative sizes of the rectangles give an idea of the comparative importance of the various commodities. Finally, the list of exports as deduced by the children from the productions is compared with the diagrams showing the actual facts; similarities are noted, and the causes for dissimilarities are inquired into, and perhaps found. This method is really heuristic; it teaches the children to inquire into actual conditions of production and exports, and to reason concerning the facts; they learn the principles of the matter, and also the facts themselves; the knowledge obtained in this way is intelligent and likely to be permanent.

Is it Worth While?

It can scarcely be doubted that the new idea of geography, and the new methods of teaching it, give better results from the point of view of education than the old could do. Both as regards the store of knowledge and the mental training there is a great gain, but one needs to inquire at what expense this gain is obtained. It must be frankly acknowledged that much more preparation is required from the teacher. It will not now serve the purpose to keep two pages ahead in the text-book. If the teacher is to be efficient he must have a definite training in the subject, yet that can scarcely be considered a disadvantage, for the gain to the teacher himself is worth the expenditure of time and trouble. Also the work in class is not so simple, for children can no longer be required to learn facts or lists from the text-book or the blackboard, nor can they be required to spend hours in the mechanical copying of maps, or the unintelligent reproduction of maps from memory. The work needs more supervision and guidance on the part of the teacher. Again, it is much harder to elicit facts than to tell them, but this is of course true in regard to every well-taught subject, and not peculiar to geography.

The gain to the scholar indeed means harder work for the teacher, but still one answers with the conviction born of experience that it is worth while and most decidedly worth while. If the work is hard, it is certainly not drudgery; it is interesting both to teacher and scholars, and one feels satisfaction in the consciousness that the work is worth the doing. Then, too, after the early stages are completed, and a scheme of things become apparent, new facts are not new burdens, but they fit into the scheme, recalling and strengthening the past work, and affording a sure basis for the future. And finally, it is the duty of the teacher to educate, and if it has been shown that the deepening of the geography syllabus means better education, teachers require no other inducement to adopt and carry still further the ideas inspiring the advance.

PHONETIC SPELLING.

ON the question of spelling reform, which has in the current year taken the place of the giant gooseberry, perhaps the most sane pronouncement we have seen is the letter contributed to the *Morning Post* of September 14 by Professor Wyld of Liverpool University. By the courtesy of the editor we are allowed to print this communication in full.

The question of spelling reform which crops up from time to time, and passionates the public mind, is again with us, started this time by a millionaire and supported by the President of a powerful Republic. Under such patronage it is doubtless felt that the matter has become serious, and many champions on both sides, for and against phonetic spelling, have emerged to plead their cause, often with more zeal than discretion. It would be idle to discuss the suggestions which may or may not be made by Mr. Carnegie's committee until something definite is known of these proposals, but it may be worth while to attempt a brief and dispassionate survey of the general question of the introduction of a phonetic method of spelling the English tongue.

First, what is meant by Phonetic Spelling? To put the answer briefly, it means a system of spelling in which every sound which occurs in a language is consistently expressed by a separate symbol or letter—a system in which no symbol is used to express more than one sound, and in which the same sound is invariably expressed by the same symbol.

These conditions are very far from being fulfilled by the system of spelling now employed in writing English. Our spelling, as it stands, is partly (1) merely archaic, as in *bright*, *rough*, *thorough*, etc., where we retain symbols which once expressed actual sounds, but which have ceased to do so because the sounds have changed or been lost altogether; or (2) it makes use of old phonetic devices to distinguish sounds once separate,

now identical, as in *seed* contrasted with *bead*, where *ee* and *ea* represented respectively two distinct sounds in the Tudor period; or (3) etymological, as in *debt*, *fault*, etc., where the *b* and *l* were introduced instead of the older spellings, *dette*, *faut*, to suggest an etymology from the Latin words; (4) our spelling is occasionally approximately phonetic in words like *pin*, *sit*, *bet*, *hen*, the reason for this being simply that the sounds in these words have not changed since the spelling was fixed.

The result of this confusion and arbitrariness is that the spelling of practically every word has to be learnt separately, that we can never tell with certainty, from the spelling alone, how a word is pronounced, nor, from the sound of a word, how custom demands we should write it.

This plan involves the expenditure of a great deal of time in learning to spell, and much pain and grief to the learner. It is claimed by the opponents of the phonetic system of spelling that this toil and worry provide an excellent mental and moral discipline for the young, a kind of healing scourge for the back of childhood. The other side maintain that our system is productive of waste of time, and therefore of waste of money, and that the state of helpless infancy is made grievous thereby. Probably both sides overstate their case.

Whatever we think of the proposal to spell English phonetically there is not the smallest doubt that its adoption, if judiciously undertaken, would make it possible for a child to learn to read in a few weeks or months, would greatly facilitate the task of foreigners of learning to read and write our language, and, further, would leave to future generations an unambiguous record of the pronunciation of at least one form of English speech in the present age. Whether these advantages are worth the unquestionable temporary inconvenience of altering an inveterate institution, quite apart from other drawbacks of a rather more weighty kind, is a question which we shall perhaps be called upon one day to consider seriously.

Let us now endeavour to examine impartially some of the chief difficulties and objections, both real and trivial, which have been or might be raised against the adoption of a consistent phonetic spelling of the English language henceforth in private and public documents, in literature of every sort and description.

The objection to such a sweeping reform as this which is most widely felt and most frequently expressed is, perhaps, that it would make a clean sweep of the continuity between present day English and the language of an earlier period, that it would destroy part, at least, of the materials for the history of our language. This is, I think, the popular argument against spelling reform, just as the alleged infringement of the rights of the parent is the popular argument against the Education Bill. I am not concerned now to justify the latter argument, but will proceed to examine briefly that which concerns a change of spelling. It appears that those best qualified to speak for the history of the language are those who have devoted some considerable time to tracing that history. So far as I am aware the objection just stated has never been advanced by any professed student of the history of English. As one whose main business in life it is to investigate the numerous problems connected with the development of the language of this country, I may say definitely that if the present system of English spelling were destroyed to-morrow and another of a purely phonetic character were substituted for it the task of the historian of the English language would be in no manner modified; in no possible way could it be thereby rendered more difficult than at present; no jot or tittle of useful material would be abolished. On the other hand, the task of scholars a few hundred years hence would be considerably lightened, since the works published in this present age would supply them with a reliable picture of our pronunciation, which they must otherwise laboriously reconstruct from the few phonetic treatises which may survive, just as we reconstruct to-day the sound of Chaucer's or of Shakespeare's speech. What does it profit the layman at the present time that our spelling has changed but little since the days of Henry VIII. or his children? Those who believe that we really "speak the tongue that Shakespeare spake" to-day, simply because we spell pretty nearly as he did, are under a misapprehension. The contemporary pronunciation of Shakespeare's plays would be unintelligible to most of us now, and he certainly would scarcely recognise his own works as interpreted to modern audiences by the eminent actors of to-day. In fact, for those who are unacquainted with the history of our language, the present spelling throws very little light; while the trained student does not need such help as it affords, having other and surer sources of information concerning the past. I respectfully submit that the care of the archives of our linguistic history may safely be left to those whose chief interest it is to guard them. The popular solicitude for the integrity of our spelling, on the score that it enshrines the past history of English, is quite misplaced. I have a shrewd suspicion that very few of those who urge this argument against spelling reform have any very clear idea of what is meant by the history of a language or could give any satisfactory account of how this had been illumined for them by our actual mode of spelling.

The next objection is that all literature written earlier than the inauguration of the reform would be so many sealed books to the generation then growing up and learning to read. This argument has as it appears no weight at all, since there are two very simple ways out of the difficulty. One way, perhaps the best, would be for the rising generation, when old enough, to make themselves sufficiently acquainted with the earlier system of orthography to enable them to read works written in it. This would offer very little difficulty to persons who had been trained in the systematic use of phonetic symbols, especially when dealing with their own language. The words in their present paper form would be quite easily recognised. The other way to place English literature before the phonetic spellers of the future would be to transliterate it into their own alphabet. This proposal not unnaturally rouses the indignation of those who believe that the soul of language, as one of your correspondents said recently, resides in the letters. I do not for a moment agree with this view of the soul of language; in fact, I know it to be false, but I can respect the sentiment which underlies it. At the same time I may point out that most of those who would be deeply grieved to see the works of Ruskin, or Tennyson, or Swinburne phonetically spelled are not offended by the popular, in some case the standard, editions of Malory, such works as Cavendish's Life of Wolsey, nay, of Shakespeare himself, which are entirely modernised in spelling. To many people an edition of Shakespeare in the old spelling, comparatively slight

as the differences are between that and our own, would be almost as irritating as an edition in phonetic character. Those who attach little or no importance to *sounds*, but regard *letters* as the main feature in literature, will hardly urge as a further objection that the phonetic editions of the old writers would represent the pronunciation of the present day, and not that which the writers themselves used. Still, when all has been said that cold reason can suggest against an unreasoning prejudice, this still survives. If you don't like a thing—well, you don't, and nothing can persuade you that you do. In any case, however, those who already know how to read can find plenty to satisfy their literary appetite printed in the old system of spelling, and they may reflect that the rising generation, assuming the reform to be carried out, will not experience the same shock to their sensibilities as will some of their elders when they behold the works of Tennyson in phonetic notation. In fact this objection comes to no more than that in this, as in all periods of transition, there will be a generation or so who will be made more or less uncomfortable by the change. Is this in itself a sufficient reason for imposing upon future ages, who will see things quite differently from ourselves, a system or institution which has nothing particular to recommend it except the fact of our own familiarity with it?

The third and last difficulty in the way of spelling reform which I shall now discuss is by far the most serious, though its solution is, perhaps, not beyond the power of human imagination to conceive.

It is a fact, as I believe has already been pointed out in your columns, that there exist various ways of pronouncing English—differences due partly to the natural variation of speech in the different provinces of the same country, partly to social differences. It is asked, quite reasonably, which of these various forms of English shall be taken as that which the new spelling shall represent? Are we to insist upon a uniform system of notation, for every class, in every province of the country, or shall we allow every community, nay, every individual, to represent his own language? There is little doubt, I suppose, that the form of English which would be insisted upon in schools (as at present) is one free from glaring provincialisms and vulgarisms, an approximation, in fact, to educated, polite English. Every child would be carefully drilled, first in the "correct" form of English, and then in the method of expressing it by written symbols. Regional and class dialects undoubtedly survive still and will continue to survive. But the Board of Education on one hand and the free means of locomotion and the intermixture of classes on the other which characterise modern life are gradually diminishing the speech differences of both kinds. To produce a fairly uniform mode of speech throughout the country would not be so impossible, therefore, as it is sometimes said. At the same time, no one will deny, certainly no student of language, that *perfect* uniformity can never be attained, and that even if it were, it could not be maintained, since this uniform language would continue to develop all over the country, and it would not develop in the same way in all provinces and among every class. In a word, new dialectic differences would spring up, and a received system of spelling, which might be phonetic for certain classes or sections of the community, would soon be very unphonetic as representing the speech of other areas and groups of speakers.

Thus, unless each individual were to express his own speech or that of the class to which he belonged, the ideal of phonetic spelling would not be completely achieved. In the case of published literature, however, a form of English that is at present in vogue among educated speakers would naturally be chosen, and consistently followed, by all writers. At the same time even this form is subject to slight individual peculiarities, and some of these would probably find expression in the spelling. In this case slight fluctuations and divergencies would exist, even in the spelling of the literary language. Again, the language of literature as recorded on paper would continue to be more or less considerably out of agreement with the language of all those whose language contained vulgarisms and provincialisms. Lastly, under this head we must remember that by definition a phonetic spelling cannot be one that is fixed once for all. It must keep pace as far as possible with the changes which arise in the natural development of the language which it professes to express, and would therefore be modified from age to age.

These are a few of the considerations which crowd in upon us when we approach the subject of this letter. They are sufficient to show that the matter is not one to be lightly entered upon.

An eminent Bishop who died a few years ago is said to have given this advice to the clergy of his diocese (a rural district in the south of England): "Let well alone, and let ill alone." This prelate was clearly not a born reformer. Some are inclined to apply his advice to the matter of English spelling. We have a thoroughly bad system of spelling, but it has served our turn for many a long year. I can see many drawbacks to retaining it as it is; I can see many difficulties in trying to amend it satisfactorily. Personally, I do not conceive it to be very vital one way or the other. I sympathise with those who would not wish to see (during our own time) phonetic editions of the English classics; but I think I could survive their appearance. For my own part, as the written symbol is nothing to me compared with its interpretation by the living sound of the human voice, I should be very glad to adopt systematically a phonetic notation in my own writing. Whatever the voice of the majority may decide in the future, it is to be hoped that neither the ignorant "phonetic" enthusiast nor the half-hearted reformer who likes to write "*color*" or "*redd*" (for "*read*") will have any hand in a new system of English orthography.

From the indications which are already visible it seems probable that either sloth, or prejudice, or indifference, or a combination of these qualities, will adjourn *sine die* any radical effort at spelling reform in this country.

Inefficient Irish Teachers.—In their annual report, the Commissioners of National Education in Ireland defend themselves for their action in withdrawing salary from national teachers for inefficiency. An exhaustive examination of the fifty-one cases given in the Parliamentary return for the year 1905 showed that in forty-nine of them the teachers had been convicted of failure before the new test system was introduced in 1900. In another case the teacher had been actually dismissed by the request of the manager, who gave reasons. The Commissioners have a good deal to say as to the inadequacy of their funds available for building grants. They give a number of striking instances of overcrowding, and unsuitable, even ruinous, school buildings, which require immediate attention.

BY MANY HANDS.

"Quot homines, tot sententiæ."

THIS judicial decision, of which we gave an account in the September number, has caused very great anxiety to Educational Authorities on the one hand, and to the managers of non-provided schools on the other, while many teachers viewed with dismay a ruling which might be employed to diminish their hard-earned salaries. There is scarcely an educational committee in which the question has not been raised in some form or other. In many cases the question has been adjourned, and payments will be made until some higher decision has been obtained, or till the members are surcharged by the auditor. This course has been adopted at Birmingham, Devonport, Bedfordshire, Gloucestershire, and Brighton. Other committees have given notice to the teachers that the payments will be made as usual in the future, but "without prejudice" to the legal decision. This course has been adopted at Willesden and in Somerset, while Cheltenham, Northamptonshire, Carnarvonshire, and a few others have already decided not to pay for the denominational teaching. Penzance has adopted a very wise course in declining to pay for the teaching, but the payment made for secular teaching is to be raised by a corresponding amount.

The West Riding Judgment.

ALTHOUGH it is part of human nature to prefer that other people should pay the expenses we incur, still it is interesting to note that some managers are willing to pay for the denominational teaching they desire. At a recent meeting of the Finchley District Council the managers of the Voluntary schools in the district offered to guarantee to reimburse the Council that amount of money which they ask to be paid to the teachers of the Voluntary schools in respect of denominational teaching. The amount was £30, 10s. for the half-year. The Council agreed (by 10 votes to 5) to accept the managers' offer, and to pay the teachers as hitherto.

The Voluntary point of View.

DURING the recess the vice-chairman, as a matter of urgency, instructed the solicitor to the L.C.C. to obtain counsel's opinion on the matter. In order to obtain the best advice, the matter was referred to Sir Robert Finlay, K.C., the late Attorney-General. The questions and their replies were as follows:—

The London Education Committee.

No. 1.—Whether the Council have power to defray the expense of religious denominational teaching in a non-provided school if they think fit so to do, and whether the auditor would have power to make a surcharge in respect of any such payment?

To this Sir R. Finlay answered:—

"On the assumption that the judgment of the majority of the Court of Appeal is right, it appears to me that the Council have no power to defray the expense of religious teaching in a non-provided school, and that the auditor would have power to make a surcharge in respect of any such payment. This is not in terms stated in the judgment either of the Master of the Rolls or of Lord Justice Farwell, but I think it logically follows from the grounds upon which they base their conclusions.

"If the construction put by these judges upon Section 7, Sub-section 1 of the Education Act, 1902, be correct, I cannot see that there is any authority under any clause of the Act for payment by the local authority in respect of religious instruction in non-provided schools.

"The case of special instruction in domestic subjects is not, in my opinion, analogous to that of instruction in religion. A grant is given in respect of the former, and under the second article of the Code a practical training in domestic subjects is to be given to the older girls where possible.

"No grant is made in respect of religious instruction, and Article 6 of the Code cannot, in my opinion, be read as supplying the want of any authority in the Act of 1902 to pay for religious instruction in non-provided schools, and if the judgment of the majority of the Court of Appeal is right it seems to me that it follows that there is no such authority in the Act."

WRONG DECISION.

No. 2.—Assuming the Council have power to defray the expense of religious denominational teaching, would they have power legally to differentiate between the various kinds of such teaching or various schools, and to defray the expense of certain kinds of such teaching and not of other kinds, or of such teaching in some schools and not in others?

In answer to question two the learned counsel says:—

"On the view which I take upon the first question this second question does not arise, and the fact that if the power existed there is nothing to prevent such differentiation is an argument against the existence of the power itself."

Replying to another question on the position of the Council generally, Sir R. Finlay expresses his opinion that the decision of the Court of Appeal is wrong. He says:—

"In my opinion the judgment of the majority of the Court of Appeal is erroneous, and I advise the Council to continue the practice which has hitherto been followed until the case has been heard in the House of Lords.

"It is, of course, possible that no appeal may be brought, but in this case the question will presumably be dealt with by fresh legislation, and in the meantime the existing practice should be continued."

After carefully considering the question, the Education Committee recommended to the Council on Oct. 9:—

"That the Board of Education should be asked whether it is the intention of the Government to institute an appeal in the case of the King *v.* the West Riding County Council, or to take any other proceedings in the matter."

This was not carried, but in its place the Council passed the following:—

"That, as the Council, in view of the decision of the

Court of Appeal, has no power to defray the expenses of denominational religious instruction in non-provided schools, the recommendation of the committee be referred back, with instructions to the committee to report forthwith to the Council what steps should be taken to provide that no payment shall be made for such instruction, due care being taken to prevent hardship to the teachers in those schools; and that authority be given to the Education Committee to enter into the necessary communications with the Board of Education."

In moving this resolution, Mr. M'Kinnon Wood, the Progressive leader, said:—

"Nearly 5000 teachers are affected, and we cannot proceed to deal with this matter simply by reducing their salaries, thus settling a political, religious, and denominational difficulty at the expense of a body of hard-working but by no means wealthy persons. (Hear, hear.) It is the duty of this Council to try to discover whether there are not some other means of overcoming the present difficulties besides that of punishing perfectly innocent persons.

School Managers' Option.

"What is the way out? I think there is one. We should say to the managers of the denominational schools, 'If you desire that religious instruction shall continue, seeing that we can no longer pay for it, you must find the means to pay for it yourselves.' (Hear, hear.) If they do so, matters will go on as they have done before, except that the cost will no longer fall upon the ratepayers. If, on the other hand, the managers of denominational schools are not prepared to find the money for religious instruction, our course is perfectly plain. We cannot pay for it ourselves, and religious instruction must cease in those schools. In my opinion, the time of the teachers should be occupied with secular instruction."

On a division Mr. Wood's proposition, which was submitted in the form of an amendment to the recommendation of the Education Committee, was carried by 72 votes against 31.

A further amendment, moved by Mr. H. P. Harris, and seconded by Mr. Whittaker Thompson, in favour of approaching the Government, was defeated by 74 votes to 33; a third, put forward by Mr. Sanders, and containing a declaration that salaries paid in either provided or non-provided schools were given for teaching in secular subjects only, was also rejected.

In the end Mr. Wood's proposal was re-affirmed by 68 votes to 31.

N.U.T. NOTES.

THERE is, of course, no direct connection between the N.F.A.T. and the N.U.T., although I believe there is still a proviso in the rules of the former organisation, to the effect that no association can be affiliated unless *at least* 25 per cent. of its members belong also to the N.U.T. Yet no one can be present at a class teachers' conference without feeling instinctively how cordial is the relationship betwixt the two professional bodies. At the Conference lately held at Nottingham, the President and Vice-President of the Union, the members for the North Midland electoral district, the Chairman of the T.P.S., and the fifteen members of the Executive, who belong also to the Federation, all took a more or less prominent part in the proceedings. Allusions to the Union and its actions were constantly being made, and throughout the thirty or so hours during which the Conference lasted, men spoke—and rightly so—as if they were an important and integral portion of the older organisation. Most complete and thorough preparations had been made by the Nottingham C.C.T.A. for every one's comfort, and a sum of considerably over £300 had been raised through the enthusiasm and energy of the local class teachers, during the preceding twelve months, for the necessary expenses attending the entertainment of the delegates. It may not be generally known that at a class teachers' conference, the whole of the delegates (whose number this year exceeded 400) are the guests of the local association at a conversazione and reception on the Friday evening, and at luncheon and dinner the following day. So not only money, but organisation, is needed to make everything go off well. Nottingham was particularly fortunate in its choice of Conference Committee Chairman, for Mr. J. S. Hardwick is a gentleman of sound common sense and wide business experience, as well as indomitable energy and great organising ability. Over and over again he has informed me what a splendid set of workers have gathered round him; and space alone prevents my including in this paragraph a lengthy list of names of men and women who have sacrificed both time and money in the interest of their professional organisations. They had their reward on the last days of September, and no more successful functions could be desired than the reception and dinner of 1906. Amongst those who spoke at one or other or both of the festive occasions were the Mayor and Sheriff of Nottingham, the three M.P.'s for the city, Mr. A. W. Black, M.P. for North Beds., who is Chairman of the Nottingham Education Committee, the President and Vice-President of the N.U.T., and quite a host of aldermen, city councillors, and other representative townsmen. Mr. Hardwick presided on both evenings, and in spite of his suffering from hoarseness and almost loss of voice made an altogether admirable chairman.

With the N.F.A.T.

THIS year's President of the N.F.A.T. is Mr. Richard T. Mawbey, of West Ham, and his tact and acumen enabled him to keep a set of brisk and strenuous debaters in first-rate order and good humour throughout. Following the excellent example of his immediate predecessor, he took one topic only as the subject of his presidential address, and no wiser choice could have been made than the "Staffing of our Primary Schools," which he handled with consummate ability. An ovation greeted the conclusion of his peroration, and the thanks of the Conference were most felicitously conveyed by Miss Sparkes — one of the best lady speakers I know—and Mr. E. C. Pritchard, whose ready wit and great debating ability would be warmly welcomed at Russell Square. Deputations from the Scottish C.T.A., the N.U.T., and the Head Teachers' Federation occupied exactly eight minutes, the pithy speeches of Messrs. Andrew Blackwood, T. P. Sykes, and J. W. Stacey being immensely appreciated and just what the delegates wanted. Mr. W. B. Steer,

At Nottingham.

of Derby, had a walk over for the Vice-Presidency, and in him the Federation has an officer whose talents and abilities are not yet adequately known. I was personally sorry to see that Mr. E. Denne lost his seat on the Federal Committee, for the Brighton gentleman is certainly in the front rank of the Federation's leaders. The *pièce de resistance* of the Conference discussions was naturally the Government's Education Bill, and over a motion of the Federal Committee—entrusted to the capable hands of Mr. Frank Goldstone—ensued as fine a debate as one need wish to hear. A great fight ranged round an amendment proposing secular schools; and although Mr. Goldstone's personal feelings would have led him to accept it, loyalty to his committee compelled him to defeat it. The Federation is, moreover, in no fool's paradise regarding the Government's measure, and lays down three proposals as absolutely essential for a just and permanent settlement: (1) The complete abrogation of a State system of denominational schools; (2) the abolition of creed tests for teachers in state-aided schools and colleges; (3) a right of appeal for dismissed teachers. The subject of "Large Classes" came next in importance, and the new Vice-President introduced the topic in a speech of exceptional brilliance. Thrice did a delighted Conference grant him an extension of time in which to complete his case, and many were the congratulations offered him on his magnificent effort. Messrs. Pritchard and A. E. Cook strove valiantly at the end of the day to benefit the Nottingham class teachers by exposing their miserly rate of remuneration, and I hope, most sincerely, that some material benefit will accrue to them as the result of the Federation's visit. Nottingham has ever held an honoured name in the annals of the N.F.A.T., and I am convinced that the happenings in the city less than a month ago will do much to enhance the reputation and public-spiritedness of the men and women, the greater part of whom I am privileged to call "friends."

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"National Committee of Teachers' Unions."

IT may perhaps be remembered that, in connection with the Liège International Exhibition of last year, the Belgian teachers invited representatives from all known European professional organisations to meet in friendly conclave, and discuss the possibilities of an International Bureau. The idea seems to have been taken up with some interest, if not enthusiasm; for at a meeting recently held at Munich, gentlemen attended from England and Wales, France, Hungary, Bohemia, Bulgaria, Holland, Switzerland, Belgium, and Luxembourg; and, as incidental evidence of the progress of the profession, one notes with satisfaction that amongst the delegates present were four M.P.'s—from England, Holland, Belgium, and Switzerland respectively. Germany was represented unofficially, whilst Norway and Spain declined to ally themselves with the movement at present. A fair notion of what the Federation hopes to accomplish may be gathered from its initial statute, which runs thus:—

> "Among the Associations of National Federations of Teachers in various countries an International Bureau is formed in order to link them together in international friendship and mutual support, in order to contribute to the progress of popular education, to assist in the improvement of the position of teachers, and to conduce towards the establishment of peace and brotherhood between the nations."

The members of the Bureau are to meet once a year, though, if more than half of them so desire, a special meeting may be held. Very wisely, in my opinion, the affiliation fee was made extremely low, the contribution demanded from each Union or Federation being—(1) Forty francs per organisation; and (2) A proportional additional amount from each, at the rate of two francs per thousand members. I learn that the above proposal emanated from the English representatives (Messrs. Sykes and Yoxall, M.P.), and the *Journal des instituteurs Belges* gives this summary of Mr. Yoxall's wise words: "If we were at the commencement to dig and plant as though we intended to produce a great tree all at once, we should probably produce nothing better than a weakly weed. But beginning modestly with a narrow programme and small financial obligations, and creating, to begin with, what might be an incomplete and imperfect piece of work, leaving its gradual completion and perfection to the operation of time, we should probably establish something of great ultimate use and present value." The Bureau will attempt to obtain during the current year—(1) Information concerning salaries and pensions of teachers; and (2) A comparison of the Elementary School curricula in the various countries, having particular regard to the intellectual development of children at a certain age.

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Large Combined Schools.

NO educational topic demands more persistent attention to-day than that of "Large Schools." Whenever I hear depreciatory comments regarding the work done in our primary schools, I always attribute their comparative non-success to two main causes: first, the small proportion of thoroughly qualified teachers on the staff; and secondly, the enormous size of both schools and classes in various parts of the country. What the ideal size of a school should be must, of course, remain a matter of personal opinion only. When the subject was first considered by an N.U.T. Conference—at Oxford, in 1894, if I remember rightly—four hundred was laid down as the maximum number of children for whom accommodation should be provided in one department, *under its own head teacher*. Later on, some of the "young bloods" of the N.F.A.T. having, as the result of much thought, consultation, and patient inquiry, come to the conclusion that the number four hundred was too large, determined to recommend "three hundred" schools as being the educational desideratum; and I had the personal satisfaction of piloting the suggestion through both the Executive and the Conference. The Board of Education would not consent to the "three hundred" limitation, although, in the closing days of the Gorst *régime*, new building rules were promulgated, setting forth that plans would not be sanctioned, in the future, for schools with higher accommodation than four hundred. It has been a little difficult at times to believe that the Whitehall authorities are altogether sincere in their desire to prohibit the erection of Gargantuan educational establishments; for I could, were it advisable, quote repeated instances where they seem to have "run away" from their own regulations, even when the proposed breach has been brought forcibly before their notice. My own decided view is that no school should be sanctioned in which

the head teacher cannot be reasonably expected to know, fairly accurately, the temperament, character, and accomplishments of each individual child; and further, that its organisation should be such that the head teacher should be able to devote a material proportion (say *half*) of his school hours to *actual teaching*. Eight or ten years ago a member of the Union sought the assistance of the Law Committee in bringing a libel action against me because I publicly denounced what I thought—and still think—the educational iniquity of allowing two departments under one head teacher. My speech was, I believe, described by the Union's solicitors as "fair comment" (or something of the kind) on what I deemed a vicious system, so I escaped the worry and anxiety of a High Court trial. Added years and experience, however, to say nothing of a term of service as head teacher, have only deepened and strengthened my conviction that schools of "three hundred" are the best that can be projected educationally. The professional aspect of the matter 'twere surely a work of supererogation to urge in these columns.

* * *

"Pro Rata" again.

AN eight-paged memorandum on "Superannuation: the *pro rata* principle," recently issued by the National Association of Head Teachers, discusses in some detail the Executive's proposals for the amendment of the Superannuation Act, "which saved the poorly paid teacher from starvation, took away the certificate from duly qualified teachers at the age of sixty-five, and satisfied nobody but those who were able to boast that they had secured a Superannuation Act for teachers"—thus runs the memorandum's summary—dismisses the decisions of the Scarborough Conference almost with a wave of the hand, and repeats, for the n^{th} time, that *pro rata* is the panacea, in fact, the only remedy, for our professional ills. Perhaps I had better say at once that *pro rata* would suit me, personally, very well indeed, as it would practically the whole of the Executive, who, whether right or wrong in their policy, cannot at all events be accused of selfishness in the matter. To describe the basis of the 1898 Act as a "fundamental fallacy" is to wilfully ignore the circumstance that, ten years ago, the great determining factor which impelled the Government of the day to introduce a Superannuation Bill *at all* was, that the average salary of the certificated teacher amounted to only twenty-nine shillings per week. Had every teacher been in the receipt of an income equivalent to that of members of the Head Teachers' Federation, a few score pensions of £20, £25, or £30 would still have been the only provision betwixt aged teachers and the poor-house. The memorandum heaps scorn on the Union's proposals because, under them, a few teachers would receive *more* than, and many teachers nearly as much as, their present salaries. I see, however, nothing ridiculous or grotesque about this. In my judgment those who, during their professional career, have been admittedly and lamentably underpaid, and who have been perforce unable to make adequate provision for the sunset of life, should certainly obtain from a grateful country some slight recognition of their arduous and responsible labours. One fatal (I had almost written "fundamental") objection to the Head Teachers' Federation's policy is the requirement of a substantial subvention from the Local Authorities. In these days, when from one end of the country to the other, the education rate is causing so great and bitter an outcry, it would be the acme of absurdity, not to say stupidity, to make the augmentation of our retiring allowance an additional cause of complaint and offence. The memorandum repudiates, with some spirit, the suggestion that *selfishness* is the *fons et origo* of objection to the Union's policy; and one notes with gladness that the sole object of the Federation is to increase the public estimation of the teaching profession. My concluding reflection is that this desirable consummation can only be secured by a loyal adherence to the programme accepted so whole-heartedly, and with practical unanimity, at the Scarborough Conference. A. C.

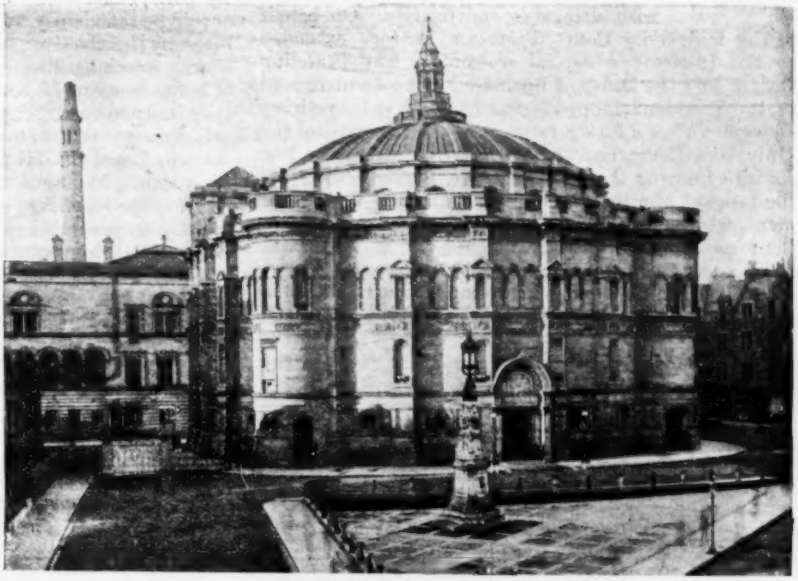
NOTES FROM THE NORTH.

The September Meetings.

THE relation between the various grades of the teaching profession in Scotland has always been of the closest kind, and the Educational Institute of Scotland proudly boasts that it has within its ranks the schoolmaster of the small village school and the professor of the University. There is no cleavage in the profession, and the new Regulations for the Training of Teachers, which have now come into operation, are bound to link more closely the bonds between the teaching profession and the University. It is but fitting, therefore, that the sixtieth annual meeting—its Diamond Jubilee—should be held within the precincts of the University. For many years, owing to the great increase in the membership of the Institute, it has been felt that the Royal High School was becoming wholly inadequate to house the delegates. This year, in glorious weather, the flitting was made, and all who were present in the M'Ewan Hall must have felt that, for the first time, the Institute had risen to the dignity of the occasion. For the first time in the history of the September meetings the gown and hood of the F.E.I.S. were in conspicuous evidence. The marvel is why it was not always so. The Publishers' Exhibits—a most valuable adjunct of the meeting—were housed in the Old University Buildings. It was possible this year to see the exhibition without having to press through a congested crowd. I am certain the publishers will welcome the change. On this occasion there were no fewer than sixty exhibits, so that teachers on the look-out for the latest, most up-to-date, and most artistic productions could not but be satisfied with the arrangements made. Many of the veterans, of course, felt themselves out of their element, and, as one of them said to me, he was quite lost and did not know his way about. Still there is every reason for congratulation on the change, and those who were responsible for the arrangements must have felt more than compensated for the extraordinary trouble they had. The change is bound to have a great influence on public opinion; and I have more than once heard it is likely to have a beneficial effect on the membership. The meeting was truly an inspiration, and if the Institute does not, to celebrate its jubilee, raise its membership to at least 10,000, it will not be worthy of its traditions.

ON the Friday preceding the Annual Meeting of the Institute opportunity is taken by several sister associations to hold their annual gatherings. First, in point of time and age, is the Burgh and Parochial Schoolmasters' Association. Thirty-four years have now passed since the last Parochial schoolmaster was appointed. No additions can be made to the ranks of those who have left their mark upon the educational history of Scotland. Each year sees a great gap in the ranks, and the membership now barely exceeds the century. The treasurer reported that only four retiring allowances had been granted this year, viz., one at £115 and three at £70. The number of acting Parochial teachers is now under eighty. The President, Mr. Thomson, Kinnoull, in the course of his retiring address, referred to Auld Hansel Monday, at one time a great institution in the villages of Scotland. On that day the children brought their hansel to the master, and he in return gave them a hansel and sent them home for the day. The school was then given over to cock-fighting, and the schoolmaster received all the "fugies" and the defeated ones. Provost Moore, Lauder, was nominated as President for the ensuing year.

The Burgh and Parochial Schoolmasters.



M'EWAN HALL, EDINBURGH.

THE next meeting consisted for the most part of the same members, who, it may be said, filed out of one door and entered by another to take their share as trustees of the Widows' Fund. These meetings were both held in the Royal High School, as notice of motion of a year requires to be given of the change of meeting-place. Dr. Menzies, Kirriemuir, the retiring President, said, in the course of his address, that the authorisation of the training of teachers scheme was the first step in what promised to be the greatest revolution in Scottish education since the passing of the Act of 1872. It would do for the training of the teacher what the Act of 1872 did for the training of the child in Scotland. There could be little doubt, he thought, that that comprehensive scheme would be the means of attracting to the ranks of the scholastic profession young men of talent and education, men who by their talent and learning would give tone to their educational system, and ultimately raise to its proper level a profession, which, whatever might be said to the contrary, held a position of comparative abjection when School Boards chose to exercise to their fullest extent the powers with which the Act that called them into existence invested them. Another great boon which the scheme conferred upon the country was the nationalisation of the Training Colleges. The scheme introduced the further great change of doing away with the pupil teacher. Altogether teachers could not but give cordial approval to the scheme of the Scotch Education Department, and receive the minute as a most comprehensive, masterly, and statesmanlike piece of bureaucratic legislation, one full of great promise to the nation and well calculated to realise the ideal aimed at. It was very gratifying, he considered, to see the change which within recent years had come over a department of State which was at one time supposed to be indissolubly wedded to a cast-iron system administered in the purest spirit of utilitarianism, and to find now a disposition on its part to give back to the schoolmaster some, if not all, of the freedom of action and right of private judgment which he possessed before the era of the revised Code.

Schoolmasters' Widows' Fund.

THE Annual Meeting is usually preceded by the meeting of the Fellows who are the final judges of the recommendations for the degree of F.E.I.S. made by the Board of Examiners and General Committee of Management. This year the various branches of the Institute recommended for the degree 42, while out of 17 applications sent direct to the Secretary *furth* of Scotland, 7 were considered worthy to receive the degree. Among those who were nominated by the Branches may be named Dr. J. E. Parrott, "the Silent Member" of the *Schoolmaster*, and Mr. James A. Menzies, Gartmore, who fought and won the recent battle of teachers' tenure of office. Those who applied direct to the Secretary were as follows: Messrs. Benjamin T. Adlard, Gainsborough; Joseph W. Carr, Embleton, Chuston Bank, Northumberland; J. A. Foote, F.G.S., Troyeville School, Johannesburg, S. Africa; Harry E. Griffiths, St. John's College, Battersea; James Harris, Higher Grade School, Barrow-in-Furness; Marmaduke Taylor, St. John's School, Bradford; and Miss Eliza Margaret Harrison, LL.A., L.C.P., London. Great satisfaction was expressed at the strictness exercised by the Board of Examiners in their selection. This year, too, nearly all those who

Meeting of Fellows.

received the degree of F.E.I.S. appeared in robe and hood, thus lending more dignity to the ceremony and enhancing its value in the eyes of the public.

PUNCTUALLY at eleven o'clock the President (Mr. Wm. Service, M.A., B.Sc., Coatbridge), accompanied by a large number of Ex-Presidents, Ex-Vice-Presidents and officials, entered the beautiful M'Ewan Hall, which was filled with delegates and friends. On behalf of the University Court, Professor Darroch extended to the Institute a cordial welcome. The Standing Orders and the Order of Business having been agreed to, the President stepped forward to deliver his retiring address. After a fitting reference to the courtesy of the University Court and to the losses the Institute had sustained during the past year, Mr. Service passed to the task set him by the General Committee of Management, who had framed a resolution for the approval of the meeting, and which the President took as the text of his address. The resolution is as follows;—

President's Address.

"The Annual General Meeting of the Educational Institute of Scotland respectfully urges His Majesty's Government to give a prominent place to an Education (Scotland) Bill in the legislative programme of the Parliamentary session of 1907.

"In order to preserve the distinctive character of Scottish education, and to ensure its progressive development to meet new conditions, the Institute is strongly of opinion that such a Bill should provide for the following points:—

"1. There should be one Local Authority administering all grades of education, primary and secondary, over a suitably large area, such Local Authority being directly elected for this purpose exclusively.

"2. The unit of area should be determined solely on educational grounds.

"3. Teachers should be safeguarded against capricious and arbitrary dismissal.

"4. The Superannuation Scheme for teachers should be made adequate."

He reminded the audience that twice within recent years they had seen the time of Parliament employed in discussing Scottish education, and twice had they been disappointed in fruition. Educational efforts had been paralysed and handicapped through inaction, and the administration of grants was at present almost chaotic in its complexity. Members of Parliament had protested against the neglect of Scotland, but no Cabinet Minister had come forward to say that Scottish education would be dealt with in the coming session. The Lord Advocate, to use his own words, had been "casting a fly to see how the trout would rise." Mr. Shaw foresaw no trouble in freshening up educational administration once the mechanical difficulties of areas and rating had been settled

MR. SERVICE expressed concurrence with the Lord Advocate's belief, that areas which were good enough for roads were not good enough for education and were never constructed on educational grounds. The Educational Institute has time and again expressed the belief that the ideal area is one specially delimited for educational purposes, but just because of the mechanical difficulties referred to by Mr. Shaw it has been content to accept the county district as the one presenting the line of least resistance. He was glad to think that a Boundary Commission was feasible, granted that certain conditions just as important as those laid down by the Lord Advocate were accepted. The first condition was that the area should be sufficiently large to have within its own borders facilities for both primary and secondary education, and that it should be sufficiently small to admit of effective management by the elective members. They had no desire for county administration by officials. The area must be of a size to allow of both control and management by the same persons. They would own up to the democratic principle to that extent. The second condition was that one Board should administer primary and secondary education. Mr. Shaw hinted at the power to combine parishes for secondary school purposes, in the same way as they were combined for purposes of Lunacy or Poor Law. Here he ventured to join issue with Mr. Shaw. Was secondary education, he asked, a thing apart from primary? Had it not been the proud boast of Scotland in the past—whatever might be true of the present—that the parish schoolmaster could prepare for the university? Was it not the case that education was a continuous process and not a thing of shreds and patches? The tradition of Scottish education was in favour of unity, and the Parish Board had always the power of spending money on higher education. They preferred to stick to the democratic principle, and to elect their Boards for education, and for the areas over which they had control, and areas that were entities in themselves. They subscribed to the *Ad Hoc* principle.

A Boundary Commission.

MR. SERVICE said that travelling facilities had changed the face of the educational map, and the ideal area for education was one determined by railway routes rather than by presbyterial boundaries. It had been alleged that teachers desired the larger area from a wish to escape from control: experts might be pardoned if they did wish for freedom of action in their peculiar domain, but they desired the larger area for weightier and more honourable reasons. Existing School Boards were too small to secure either economy or competency of administration. By larger areas they would reduce the number of boundaries and thereby economise the provision of school accommodation to get rid of the inconveniences to which scholars were subject under the present system of parish limits. The problem of compulsory school attendance would be more satisfactorily dealt with. A most desirable reform in the incidence of rating would be effected, and it would be possible to co-ordinate primary and secondary education in one consistent system. So long as the different stages of the educational process were controlled by different authorities no adequate justice could be done to its real continuity. The mere combination of elementary School Boards could contribute nothing to this end. The Board produced by combination was a bad authority for secondary purposes, and remained entirely separate both in its powers and duties from the Parish Boards out of which it was formed. He did not require to urge that district Boards would not fail to be more truly representative, that they would make public control more real, that the better method of electing

Larger Districts.

their members would prevent the intrusion of the irrelevant issues which at present obscured the choice of representatives, and that they would provide a wider sphere for educational work and attract better men; each parish, having to elect only one or two members, would be likely to do what it could to secure the services of really competent representatives.

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Professional Advantages.

A FURTHER advantage, the President said, though not so obvious, yet of even greater importance, was that district School Boards would gradually be able to secure a more adequate staff of competent teachers. This was a final factor in educational reform, and questions of machinery, important as they were, usurped a place which was not their own if they led them to forget this fact. At present the teaching profession did not compete in an effective way with other careers, for the conditions of employment in it were unsatisfactory. District School Boards, controlling larger areas, and being in other respects more weighty and stable authorities, would diminish the risk of capricious treatment of teachers. They would help to solve the vexed question of dismissal. They would reduce the chances of personal friction between the teacher and the Board. In addition, they would be able to provide for the removal of a teacher to a new post as an alternative to dismissal, and to simplify and rationalise promotion. Subordinate posts would be more easily filled when they were recognised as steps to better positions, and in this respect the District Board would work more economically. Finally, the unification of primary and secondary education would throw open the whole career of public teaching to the competent men.

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Superannuation.

AS was to be expected at the present time, the President devoted part of his address to the question of Superannuation. The superannuation scheme, he said, had been in operation now for seven years, and the best that it had done for man or woman compulsorily retired at sixty-five had been a grant of £45, 16s. 8d., and the worst a smaller pittance of £17, 10s. a year. The average was £32, 7s. 6d. The Superannuation Act had been accepted by Scottish teachers on the principle that half a loaf was better than no bread. It was only the last year or two that it had begun to be realised how miserably poor was the quality of the bread, for it was only within these years that pensions had begun to fall due in any number. Bad bread and little of it, even for those who had not been nursed in the lap of luxury, first engendered uneasiness, then excited what Mr. Birrell called "divine dissatisfaction," and then aroused angry protests of discontent, for a hungry man was an angry man. This discontent among teachers had been growing silently for some time; but its volume had recently increased, and it would continue still more rapidly to grow, for more men and women were year by year beginning to experience the full significance of the harshness of the scheme. Discontent had found utterance, and the storm of indignant remonstrance that had been gathering in every successive meeting of their committees had stirred their representatives to action, and they were not likely to rest till some amelioration—nay, assent to some drastic reform—of this offensive measure was wrung from an unwilling Treasury. The Lord Advocate remarked that the teacher of to-day was rapidly becoming an integral part of the national professoriate. They thanked him for the word, and if only he would use his undoubted influence in helping to secure for the aged and incapacitated of this national professoriate a superannuation scheme worthy of the nation, he would find himself in excellent company.

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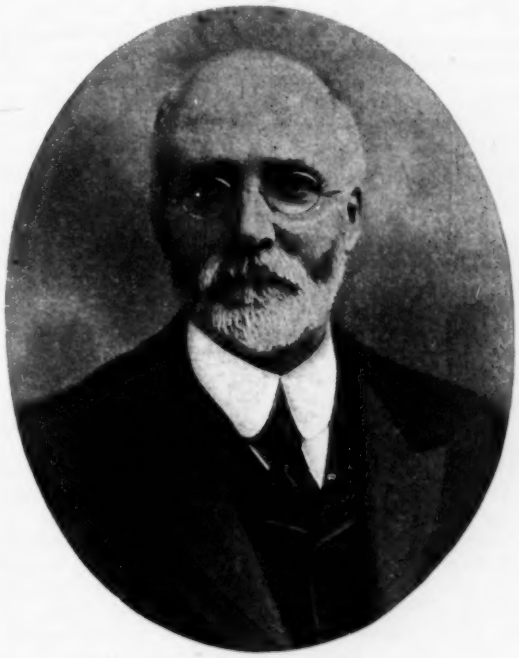
Election of Officials.

AT the conclusion of his address Mr. Service nominated as his successor, Mr. John Mudie, Glebelands School, Dundee. Amid applause he transferred to the new President the golden badge and chain of office. In a word Mr. Mudie thanked the audience for the honour conferred on him. Mr. Watson, Dumbarton, an Ex-President, in a chaste speech moved a vote of



MR. JOHN MUDIE.

thanks to the retiring President, who was then adorned with a gold replica of the link in the chain of office. Mr. James Will, M.A., New Pitsligo, was then nominated as Vice-President. Mr. John Laurence was re-appointed Secretary, and Mr. S. M. Murray, Treasurer and Organising Secretary. Last month I gave the financial statement, so it is not necessary here to refer to the subject again. In order to take some of the responsibility of the investments off the Finance Committee, it was moved, "That this meeting of the Educational Institute of Scotland approves of the investments of the Institute as stated in the State of the Funds." Dr. Dickie, Girvan, was re-elected Secretary to the Board of Examiners, and the formal business was at an end.

THE delegates were very slow in resuming their places in the afternoon, so that when the business was begun a motion to count the house was made but rejected. It is evident that next year recourse for the afternoon sederunt will have to be made to one of the class-rooms of the Old University for two reasons—first, to be nearer the Publishers' Exhibits, and second, that the audience may not be wholly "wood." Another change I would like to see is that the afternoon session should be a private one. The most of the business in the afternoon consists of the approval or disapproval of the Minutes of the General Committee of Management, and very largely consists of domestic policy, which can have little or no interest to the public. It is the time, too, when steam is let off, and the exhibition is not always a pleasant one. For many reasons, therefore, I should like to see the Institute having a "private" session.

Afternoon Sederunt.

THE first thing that broke the placid calm of the meeting was the discussion on Parliamentary Representation. An overture had been made by the Inverness Branch to the following effect: That the G.C.M. take such steps as they deem necessary to make provision for the direct representation of the Educational Institute of Scotland in Parliament. This overture was considered by the Parliamentary and Emergency Committee, who came to the following finding:—

Parliamentary Representation.

"The Parliamentary and Emergency Committee desire to record their hearty agreement with the object aimed at in the Inverness overture, and their appreciation of the great advantage that would accrue to the profession if one of their number secured a seat in the House of Commons. In order to be in a position to attempt such direct Parliamentary representation of the Educational Institute of Scotland, it would be necessary (1) to raise a Parliamentary Election Fund of, say, £2000, and (2) to levy an additional special annual subscription of, say, 2s. per member."

This finding, however, characterised as a "pious opinion," did not meet the approval of several of the delegates, and a motion to the effect that it be an instruction from this meeting to the General Committee of Management to take steps to make provision for the direct representation of the Educational Institute of Scotland in Parliament was carried by a majority. In these Notes I have frequently referred to the necessity for such a step. As an Institute we shall never wield the power we ought to do until we have a member of our own at St. Stephen's. I am therefore glad to find that the motion was accepted, and I trust the "Ca-canny" policy of a few is now at an end.

AFTER a rather heated and somewhat protracted discussion on the question of superannuation—as to whether a new scheme or an improved scheme was to be asked for, whether there should be proportional or fixed contributions—the question of the establishment of a Provident and Dependants' Fund was spoken to by Mr. Arneil, Glasgow, the Convener of the Sub-Committee, on this subject. He showed the necessity for such a scheme, and moved that the report should be sent down to the Branches for consideration. The next important discussion ranged round the size of the General Committee, and here, too, after a very long discussion, the report of the Committee was approved, so that in future the area will be the county and the unit 200. The General Committee will thus be reduced to 46 as against 73 this year. The rest of the business evoked little interest, and a vote of thanks to the President closed the first Annual Meeting held under the ægis of the University.

Provident and Dependants' Fund.

ONE of the stated meetings in connection with the Annual Meeting takes the form of a Ladies' Meeting. During the last few years this meeting has increased in importance, as is evidenced by the great increase in the numbers attending. The chair was occupied by Miss Stephen, Elgin. A pleasing feature of the meeting this year was the presentation of a marble clock with bronzes, a gold chain and a purse of sovereigns to Miss Hamilton, the retiring Vice-President of the Institute. The presentation was made by Mr. Service, Ex-President, who paid a generous tribute to the successful work done by Miss Hamilton during the past year. Mr. Duthie, Aberdeen, and Mr. Menzies, Gartmore, also addressed the meeting. Various papers were given by lady teachers. Miss Cameron, L.L.A., Annan, read a very interesting paper on "Some Problems in Infant School Education." She dealt with the following propositions: Would it be wise to have only a forenoon attendance during the first year at school? What might be considered judicious promotion? Is the basic number of our conventional Arabic notation still to be treated as the keynote to number? Should there be medical inspection of under average school children? Miss Whitton, Kirkcaldy, spoke on the same theme, and discussed the age at which the child should be admitted to school, the question of attendance, the necessity for regulation in diet and sleep, medical inspection, home lessons, the infant school as the basis of all school work, and the need for co-relation between the various divisions of a well-governed school. Miss Mitchell, Edinburgh, Convener of the Institute Ladies' Committee, gave an account of the work done during the year, and urged upon local Committees the importance of deliberately discussing the subjects sent down to the Branches.

Ladies' Meeting.

R. D.

School Nature Study Union.—At the meeting of this union held on October 18th at the College of Preceptors, the Rev. Canon Horsley, Vicar of St. Peter's, Walworth, gave an interesting lecture on the "Beauties and Wonders of Land and Fresh Water Shells," with special reference to those found near London. The next meeting is on Wednesday, November 21st, at the same place, when Mr. W. Cross will deal with "Flowers of the Field." The chair will be taken by Dr. Kimmins at 7.45. Particulars of the work of this society may be obtained from the Secretary, Mr. H. E. Turner, Bellenden Road H. G. School, Peckham, London, S.E.

University of St. Andrews.—The recently published calendar of the University shows that for the L.L.A. Examination in May 1906, 989 candidates entered for the examination, as compared with 975 candidates in 1905. No doubt the thousand will be reached next year. The L.L.A. diploma will be conferred on the 89 candidates who have completed the requisite number of subjects.

School of Five.—At a meeting of the West Sussex Education Committee it was reported that at the village school of Coates there were only five scholars on the books.

FOREIGN NOTES.

ALL about Russia[1] is the somewhat ambitious title which Mr. Marsden (an old contributor to this journal), whose long residence in Moscow has afforded him exceptional opportunities of observation, gives to a weekly periodical, the first number of which appeared on September 17. Recent events have fixed the eyes of all Western Europe on the empire of the Czar, but while the knowledge of what is happening there gradually filters through more or less completely to the outside world, the ordinary Englishman feels that he is in presence of facts which he can only partially understand and account for. Mr. Marsden's journal helps to fill up these gaps in one's knowledge. It is written by a skilled journalist, and its contents are varied and interesting. The Englishman's failure to understand fully what is happening in Russia is partly due to the fact that he does not realise what Mr. Marsden insists on in his first article. "The Russian Government," he says, "is, in essentials, Oriental to-day, as the ruling classes were Oriental two hundred years ago, when Peter the Great forcibly imposed upon them a thin veneer of European civilisation. This veneer has extended in many directions since the days of Peter the Great, but it remains a veneer only." Hence he points out the futility of comparing the present situation in Russia with the development of the French Revolution. Nor does the ordinary Englishman rightly appreciate the strange and complex nature of the Slav, in whose acceptance of social and political theories the emotions have an equal share with the intellect, and who, without thinking he is doing anything particularly heroic, carries out his principles to their utmost logical consequences, at the sacrifice of rank, wealth, and even life itself.

The telegraph offices, acting on direct instructions from the Government, refuse to accept messagés animadverting on burning political questions. This refusal, combined with the more rigid censorship of private correspondence which prevails, no doubt accounts for the peculiar method of production Mr. Marsden has chosen for his journal. It consists of sixteen typewritten pages, in a brown paper wrapper held together by paper-fasteners.

Mr. Marsden's articles on the "Black Gang" contain a great deal of what will be new to most Englishmen. It is a natural development of an organisation which has been discreetly used by the Russian police for a generation past. Whenever it was necessary to organise "loyal crowds" on the occasion of a public function in which some Imperial personage took part, the police were directed to select "men of good promise," or, in other words, men from whom politically the bureaucracy had nothing to fear. These were carefully drilled in their parts, and provided with passes by the gendarmes. When the great day came off, these loyal subjects were marched into the place appointed under the direction of the police of their districts, ready to cheer whenever the signal was given. On the day following the celebration the subsidised newspapers wrote enthusiastic accounts of the loyal demonstrations, multiplying the demonstrators by any number from one hundred to one thousand.

General Trepoff, for a time High Police Master of Moscow, and the greatest policeman of his age, gave this practice a further development by organising demonstrations in favour of the unpopular Japanese war; but as the decent burgher class shared the general dissatisfaction with this war, he was obliged to recruit his "loyal crowds" from the lowest classes of society, who were to be had for a slight payment in cash and unlimited vodka. These proved less amenable to discipline than the stolid middle-class men who had formerly acted under police direction, and, safe under the patronage of the police, they delivered themselves to all sorts of excesses, such as lamp smashing, pillaging shops, and beating all who did not uncover at their command, until at last the Grand Duke Sergius gave orders to disperse all crowds, whether carrying flags or not. When the political crisis which followed the war arose, the Black Gangers were again called into existence in the interests of the Conservative party and the bureaucrats. It is they who have been responsible for the "pogroms" at Siedlice and other places. As the "Union of True Russians" they form a regular organisation, and are holding a Pan-Russian Congress at Kiev this month. Fifteen persons at least are sufficient to form a "centre," and are qualified to address telegrams to the Czar "in the name of all true subjects." These telegrams, the text of which is issued circularly from Moscow, are frequently quoted in the Government Gazette as proofs of the loyalty of the majority of Russians to the autocracy. As a matter of fact, the various Conservative sections elected less than five per cent. of the members of the late Duma. The Constitutional Democrats, who represented ninety per cent. of the Russian people, are refused the official authorisation necessary to legalise their existence on account of the "indefiniteness of their aims." Being treated as non-existent they are not allowed to hold meetings.

Mr. Marsden's journal cites numerous instances to show that the autocracy, in its attempt to crush the aspirations of the Russian people for constitutional government, is governing Russia in defiance of the fundamental laws of the empire, and giving to petty officials practically powers of life and death over the people at large. Any one brought before the drumhead court martials which have been established over nearly the whole of Russia has little chance of getting justice. By Government order, no officer possessing a knowledge of military law is allowed to act as a member of one of these courts, and great pains are taken to keep from the public the names of those who compose them.

The whole of the contents of these periodicals is of absorbing interest. Mr. Marsden's indictment of the bureaucrats who misgovern Russia is bold, and carries conviction with it. We trust he will continue the work he has commenced, and recommend all our readers who desire to get a true idea of the present state of affairs in Russia to support him in his enterprise.

[1] *All about Russia*, Nos. 1 and 2, edited by Victor E. Marsden, M.A., 37 Prechistensky Boulevard, Moscow.

The Cusack Institute.—This Institute is well known to teachers, and there is no need to refer here to its past services in preparing for the various professional examinations. We are pleased to note the development along the lines of commercial education. Successful classes are now working in shorthand, bookkeeping, and other business subjects.

OUR CLASSROOM AIDS.

GREEK SCULPTURE IN THE BRITISH MUSEUM.

I.—THE PARTHENON MARBLES.

[Most of the illustrations to these articles are copied, by the kind permission of Sir E. Maunde Thompson, from lantern slides which are published by the Trustees of the British Museum for the use of schools. They are on the list of the London County Council, and can be borrowed by head teachers in the Council schools (day or evening) on application. It is thought that if pupils have their attention drawn to essential points beforehand, by means of a lantern lecture, they will profit to a much greater extent by their visits to the Museum.—W. E. S.]

THE fifth century B.C. is the brightest in the history of ancient Greece. Yet it opened with threatenings of war and disaster, for the great Persian power that had raised itself on the ruins of Assyria began to assemble her armies and navies to attack the growing power of Athens. There was nothing to which the later Athenian looked back with greater pride than the part played by his forefathers in repelling these invasions. The overthrow of the Persian army at Marathon (490 B.C.) is only to be equalled by the decisive and glorious naval victory at Salamis (480 B.C.), when Xerxes was driven back in utter confusion. In drama and in sacred hymns alike, in works of art—sculpture, mosaics, vase-paintings—the echoes of these glorious times were carried down the ages. Marathon and Salamis became words to conjure with; two thousand years later sober members of a British Parliament could find no better terms in which to praise the nation's victories by land and sea than these—they equalled Salamis and Marathon.

By their defeat of the Persians, the Athenians found themselves raised at a bound to the highest power and prosperity among the Greek States. And this exalted position is reflected in Athenian art; for it is never to be forgotten that in a nation's art we read the changes in thoughts and emotions through which the people, as a whole, pass. There is always some strong tendency—or, in less noble times, some apology for earnestness—which inevitably stamps itself, in the form of art, upon all the productions of the age. The French Revolution, with its ideals of government based upon the conduct of the ancient free Greek States, marks itself down not only in architecture, sculpture, and painting, but also upon the slight "accidents" of life, its dress, furniture, and adornments. Everything was run in a classical mould; from a church to a candlestick it was "all Greek."

And the outcome of the Athenian victories was to ennoble the city with fine buildings. Their massive form and matchless sculpture would have been impossible to a defeated and dishonoured people; their combined strength and refinement point to men living in a proud, prosperous, and cultured ascendency. The Athenian of the fifth century B.C. stands revealed in his temples.

Athens is happy in its situation. It lies in a fertile plain spreading four miles till it reaches the sea, which enters the land by three harbours. Behind Athens rises a great massive rock 150 feet high, its summit formed by a flat plain measuring 1000 feet by 500. This was the citadel, the Acropolis of the ancient city; the refuge to which the inhabitants might flee when hard pressed by their enemies. A winding path led upward from the city towards a gate in the thick heavy wall which compassed the summit. Within the wall stood temples raised in honour of the protecting gods.

With the success of her arms by land and sea, Athens began to beautify the Acropolis. Splendid gates (the Propylæa) were built; the temples were renovated, one at least being entirely rebuilt. This was the marvellous Parthenon, the most celebrated in the world for its exquisite harmony.

It was designed by the architect Ictinos, and its sculptures were put into the hands of Pheidias, who still holds the highest station in the world's art in sculpture. It was begun 454 B.C., and completed in sixteen years.

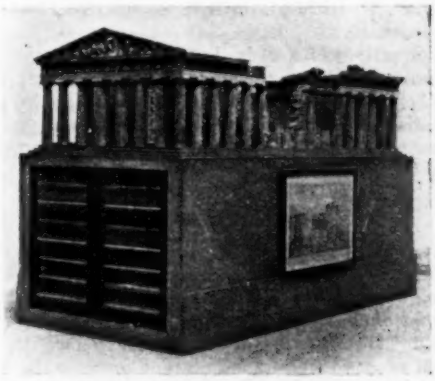
THE PARTHENON—ITS PLAN.

This marvellous building, like all ancient Greek temples, consisted of a small cell in which the statue of the goddess stood in awful isolation. The priests alone entered this sacred cell. At the back of this was a

room for treasure and for the sacred vessels; doors led both to the cell and the treasury. Here we see the difference between the Pagan and the Christian idea of divinity, the Pagan temple containing the divinity, while the Christian is the place for assembled prayer and praise.

Before the cell was a covered way supported by pillars (the Pronaos) where the worshippers assembled; while another and broader covered way, also pillared, ran round the entire building. Here the townsmen and foreigners walked in the cool shade; it was a pleasant rendezvous. From the steps the city could be seen lying in its fertile fields, while, beyond, the sea flashed, and the ships crowded into the harbours.

As may be understood from the plan, there was thus a double row of columns at either end of the



Model of Parthenon after Venetian Bombardment.

temple. This is still more clearly indicated in the sectional view below.

There is no space here to speak fully of the varied fortunes of the temple. It was standing gloriously complete when Paul preached at Athens; it was still complete in 430 A.D., when it became a church; the Turks, in 1458, converted the church into a mosque; and when in 1687 the Turks were attacked by the Venetians, it was used as a powder magazine. An unlucky shell fell through the roof, and the explosion which followed wrecked the building. This photograph from a model shows its state to-day.

The Story told by the Sculptures.

Let us imagine the temple in its perfect state. As the traveller climbed the hill from Athens, he entered the massive gates of the Acropolis, and, turning to the right, saw before him this glorious Parthenon, built entirely of white marble, and shining against the deep-blue sky. He would first see the eastern end, its triangular pediment filled with gigantic figures, while below the pediment were fourteen smaller plaques also filled with sculptures. All this wealth of art was supported upon eight severely simple pillars admirably proportioned.

If the traveller now passed down either of the long sides of the temple he would find this row of plaques continued until he reached the western end of the temple, which had an exactly similar pediment to that on the eastern side. But the sculptures filling the pediment differed entirely.

The Sculptures in the Eastern Pediment.
The First Part of the Sacred Story.

There were cities in ancient Greece given up to the cult of some particular deity. The Delphians worshipped Apollo, whose oracle was set up in the city; "Great was Diana of the Ephesians;" and Athens built her most magnificent temple in honour of her tutelary goddess, Athene, the Virgin (Gr. Parthenos).

This cult dated from very ancient times, but had not weakened through the ages, though, doubtless, among the cultivated Greeks of the fifth century, the stories of Athene tended more and more to become motives for poetical treatment rather than for implicit belief. The Greek intellect could invest these stories with a thousand charms; the pursuit of beauty, its expression in literature or art, was become a passion: Athene and the whole of the Olympian deities were fit centres about which intellectual art could spend its best; for these hoary traditions had that one element of *age*, which, in itself, touches at the heart of interest. And, doubtless, the stories of Athene were implicitly believed by the less cultured Athenians, in spite of the learned scepticism which, even then, seems to have been common.

Still, artistically or religiously, the ancient myths swayed the Athenians powerfully.

One of these was the birth of Athene (Minerva), who sprang fully armed from the forehead of Zeus (Jupiter). The old legend ran that, at the command of Zeus, Hephæstos (Vulcan) struck him on the forehead with an axe, and the goddess sprang forth.

This is the subject for the marvellous composition that filled the eastern pediment of the Parthenon. Time, war, theft have all played their part; from the mutilated statues that remain it would have been impossible to read such a story. But, fortunately, a Greek traveller, Pausanias, seven centuries later made a record of the ancient works still remaining. It is from him we learn the subject of this and the western pediment.

From various ancient sculptures and reliefs, supposed to be copies of this masterly composition, authorities have attempted to reconstruct the scene; but they must necessarily be open to grave doubts.

Below is one such suggestion which is useful, at any rate, as a guide to the following remarks.

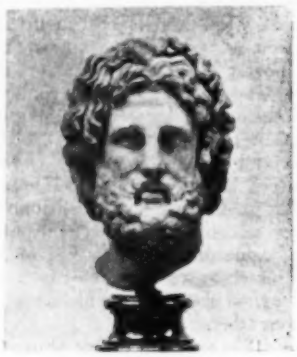
Zeus.

Undoubtedly, Zeus himself, father of gods and men, would occupy some point near the centre; and, in accordance with Greek custom, would be seen looking to the front. The Greek sculptors of that day had elaborated their art, until the types of the gods had become ideal. Zeus is a handsome bearded man, with full, fine-proportioned features; the eyes are far apart, the projection above, and the broadening of, the nose being particular marks of divinity in Greek sculpture. The lips are almost invariably slightly apart, so that the finely modelled forms may be expressed evenly and without constraint. The forehead is perpendicular and high, rising towards a domed height from which the abundant hair falls right and left in well-marked, finely designed, waves. The beard was thick, well-rounded, close-clustered. Such a head of Zeus was supported by a strong neck "like a tower."

These artistic attributes (without a crown or other

mark of royalty) afterwards became common types for lesser, but still grave and dignified, gods. The head produced below, undoubtedly approaches the type of Zeus as he would appear in the Parthenon sculptures, though this particular head is thought to represent Asclepios, the patron of medicine.

The sculptures of Zeus, Athene, Hephæstos, and the other mighty figures that stood, far larger than life, in the centre of the eastern pediment, have all disappeared. A French artist, Jacques Carrey, in 1674, made several sketches of the Parthenon and its parts. Even in his day, there were no remnants of the great figures in the centre of this pediment; and since then, other portions disappeared. His sketches help us to "place" the sculptures that remain, treasured jealously for the most part in the British Museum.



HEAD OF ASCLEPIOS.

THESEUS.

But to return. One of the very finest of the sculptures (thought by some art critics to be the grandest example of sculpture in the world) is generally known as Theseus. It is evident that, without supporting evidence, the names given to these figures cannot be certain; and it would be out of place here to canvass the reasons given by authorities for their attributions.

THESEUS.

This magnificent figure would suit well with the traditional Theseus, friend of Heracles (Hercules); the hero who in Greek story, far back in the dim ages, first drew together the tribes and united them at Athens under his leadership.

He sits reclining on a rock. In his right hand he probably held a staff or spear which came down to the left ankle, where a hole is still to be seen, probably at one time containing a metal stud or support. He rests on a skin of either a lion or a panther, as may be seen from the claws.

There is another interpretation of the statue. The birth of Athene occurs on Mount Olympos. Now the Greek mind delighted to represent mountains, forests, rivers, the sea, and even the sky by human figures. The smooth-flowing river appears as a nymph or a gently inclined, softly curved god; Poseidon (Neptune), with all the attributes of resistless strength, was, at one and the same time, the sea itself and the ruler of the sea; and so on. Now Brunn sees in this so-called "Theseus" the Mount Olympos illuminated by the rising sun. It will be seen at a glance how admirably the figure fits within lines that would give the outline of a mountain.

After all, while this is deeply interesting, the question of this statue's standing in art is beyond doubt. Its splendid ease and massive strength, its suggestion of manly activity and grace, and the perfectly constrained art by which all this is expressed, stamp it as a masterpiece.

HELIOS (THE SUN).

But, whether Theseus or Mount Olympos, he serves another purpose in the composition. The miracle of Athene's birth has not yet reached the outskirts of Olympos, and this figure sits with his back to the startling scene. From him there seems to be a growth of interest and movement towards the centre—a most artistic means of concentrating the drama, while at the same time surrounding it with beings connected with the principal characters.

He sits, then, calmly looking towards the rising sun, the chariot of which rises from the sea to begin its daily course. The four horses are full of fiery energy, finely indicative of dayspring. Two horses are among the Museum marbles; the outer one must have projected beyond the pediment, so as to catch the first rays of the rising sun—one poetical beauty among the many refinements of the Parthenon.

SELENE (THE MOON).

Now carry the eye to the extreme right of the pediment, where another charioteer with his team bounds the scene. Two horses' heads still remain at Athens, but one is in the British Museum. In the

HORSE OF SELENE.

whole range of art there is no example where the sculptor has shown greater power to express, in the stubborn marble, the various forms and coverings. The hard frontal and jaw bones are strongly marked; the muscles are drawn taut on the bridle; while, by a different handling, the upper lip and nostril seem to be quivering like those of a horse at the end of a sharp race. The chariot of Selene (the moon) is descending into the sea. The horses contrast strongly with Helios' team, springing vigorously from the sea; Selene's car drops gently beneath the waves, her horses lowering their heads as they sink.

The miracle takes place within the course of one day, from the rising of the sun to the sinking of the moon!

Iris.

Next to "Theseus," who sits complacently facing the sun, two female figures are seated. As their heads are lost, it is impossible to judge the action except by reference to movements indicated in the necks. All authorities agree that they were looking at each other, but turned slightly towards the centre as though the news of Athene's birth is beginning to permeate all parts of the sky and the earth. Perhaps they represent Demeter and Persephone, who, next to Athene herself, were worshipped in Attika.

The goddess next to them, however, is violently agitated. She runs rapidly, her robes clinging closely,

Iris—(East Pediment of Parthenon).

and her mantle blowing out like a sail with the rapidity of her movement. It is generally thought that this is Iris rushing from Olympos to carry the glad news to the world outside. If so, the two seated figures may be the guardians at the gate of Olympos, roused by the winged coming of Iris.

The Three Fates.

We now pass again to the right of the pediment, where, next to Selene's chariot, are seated three female figures. They are headless and armless, but there are sufficient remains to indicate their action. Moreover, in Carrey's time, the head was still intact on the lying figure, and shows her to have been looking placidly towards the moon. The news has not yet reached her. Her companion, however, catches a sound, and draws back her feet as one would to rise. The third figure is still more alert and upright; in another moment she will be standing to catch the startling news.

The master sculptor of the Parthenon was Pheidias. Nothing shows his extraordinary gifts more certainly than the manner in which he attacked not only the difficulties of the human figure, but also those of the draperies that clothe it. In this group of the three sisters—The Fates—there is marvellous skill. The

The Three Fates.

draperies conceal and yet modestly reveal the figures; the creases and folds explain the movement of the limbs; the curves are richly composed, flowing from one figure to the other like waves, as though the waking from sleep of the Fates is rhythmical and without the disorder that might be proper to mortality. Even the small photograph shows how wonderfully the sculptor marks the difference between the softer clothing with its small folds, and the heavier outer woollen covering that falls and stretches in long, deep grooves.

Nike (Victory).

But for delicacy of treatment, even these figures do not excel the Nike which springs near them. Her energy explains her action: the miracle of Athene's

Victory.

birth is heralded to every corner of the universe. Athene is born; Athene who shall be the guardian of arms and learning. Could any goddess be more fittingly announced to a nation of warriors, artists, and

soldiers? It was surely not without reason that the Athenians, maintaining their character as scholars down to Paul's day, chose Athene as their tutelary deity.

The story of the eastern pediment is thus clear in its essentials, though its details may be obscure. Athene is born; the news is carried right and left by Iris and Nike; mortals and immortals catch the glad news which flies through the universe between the rising of the sun and the sinking of the moon beneath the waves.

The Story of the Western Pediment.

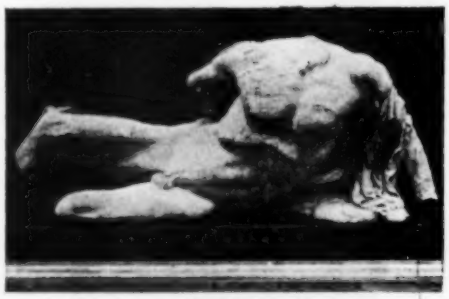
It is not possible to tell this story in such detail, as it would not be very clear without photographs. But Pausanias, the Greek traveller of the second century A.D., tells us that the subject was the contest between Poseidon (Neptune) and Athene for the soil and worship of Athens and the cities about her throughout Attika. In Carrey's drawing this pediment was much more complete than the eastern; but since 1674 much has been lost. From his drawing we see the two contestants standing, but in strong movement, in the centre of the pediment. Athene's chariot stands beside her, while the various figures that fill up the narrowing space were probably deities connected with Athene and the land.

Behind Poseidon, there is a space in Carrey's drawing. Most likely, as a balance to Athene's horses, there was here a chariot. The figures to the right were probably sea deities who accompanied Poseidon (Neptune). The attempted restoration agrees very well with Carrey's drawing, and the parts filled in may be taken as suggesting the grouping of the figures.

Poseidon begins the contest by striking the ground with his trident, producing a salt spring. Athene replies by making the soil give birth to an olive tree. She was acknowledged the victor.

What was the meaning of the myth? That the wealth and power of Athens and Attika were to be derived from her fertile plains, her olives, her honey, her inland traffic? That the sea might claim her sons to venture trade abroad, but that this was to be only secondary, her true policy being to cultivate the land?

By common consent the sculptures remaining of the western pediment do not equal those we have already



Ilissos.

described. One, however (the figure lying in the left-hand corner), has a grace and an ease beyond the rest. It is often thought to represent the Ilissos, one of the two small rivers passing by Athens. Its curve and general disposition would agree well with a river, and would be quite in agreement with Grecian procedure in art.

. . . . . .

The Pagan visitor to the Parthenon, in those far off times, would thus have before him, in the noblest form, the two incidents in the tradition of Athene upon which the Athenians based their pride in her worship. She came forth from the head of Zeus, the embodiment of his intellect, the essence, as it were, of his governing power in peace and war. She thus became peculiarly the patron of learning as well as the guardian of her favourite city.

In the other story, Athene secured the soil of Attika. In the course of the ages her intellect and martial power, derived from Athene, had made Athens (in this fifth century B.C.) the centre of learning and arts, the head of the Greek States, the conqueror of the dreaded Persian host.

What better subjects could Pheidias have selected to adorn this most exquisite of temples?

(*To be continued.*)

"WHAT MEAN THESE STONES?"

THE STUDY OF ARCHITECTURE IN ITS RELATION TO HISTORY.

BY EDMUND A. GREENING LAMBORN,

Headmaster S. Mary Magdalene Schools, Oxford.

(*Continued from p.* 183.)

THE TRANSITION PERIOD, 1180–1200 A.D.

WE have now reached the point when the Teutonic people had transformed the derived Romanesque style of architecture, by impressing on it their racial spirit, till it possessed three of the great characteristics which, as Ruskin has shown, mark the Gothic style—variety, grotesqueness, and redundance, reflecting three great Teutonic moral attributes, the love of change, imaginative power, and generous enthusiasm, remaining Classic only in its fundamental principle of being an architecture of the round arch and the low gable. The discovery of the pointed arch, which was made in the latter half of the twelfth century, and its almost universal adoption before the end of the century, removed the last link of the Northern architecture with the Classic styles, and architecture in the Teutonic countries henceforth for three centuries becomes completely the expression of racial characteristics, instinct with the spirit of the Gothic peoples.

In the buildings of the last quarter of the twelfth century, the characteristics of the Norman style are seen mingled with those of the succeeding one in embryo. At Wimborne Minster, 1175, the nave arches are pointed, but all the enrichments are pure Norman. Frequently the Early English dogtooth ornament is found carved in the mouldings of a round arch, and sometimes, as at Cuddesdon, Oxon, it is used in combination with the Norman lozenge ornament. The presence of rude foliage of three-lobed leaves on the capitals is also a mark of the period. The chisel having entirely superseded the axe as a graving tool, the mouldings have deeply cut hollows, but the "rounds" between them are heavy, like the Norman string-course. A deep hollow in the bases of the pillars, now

to be noticed, distinguishes the "water-holding" base used throughout the Early English period. The windows were probably long and narrow, with round heads as a rule, though many were doubtless lancet-shaped, as in the succeeding style. An illustration of the flat corner-buttresses of this period was given in the last article.

THE GOTHIC STYLE, 1200 A.D.–1500 A.D.

The Outward, Visible Signs.

In the three centuries of its existence, Gothic architecture, in England at any rate, shows three well-marked stages of development—a period of gradual growth, in the Early English style, from about 1200 to 1300, a shorter period of beautiful maturity 1300 to 1380, the Decorated style, and a period of gradual decline through the Perpendicular style, till early in the sixteenth century the degenerate architecture was abrogated in favour of the revived Classic models.

THE EARLY ENGLISH OR FIRST POINTED STYLE, 1200 TO 1300 A.D.

For the first part of the period, the work retains much of the massive solidity of the Norman style. The walls are of great thickness, and the windows in consequence are widely splayed. The arches are nearly all acutely pointed, and the windows of the long narrow

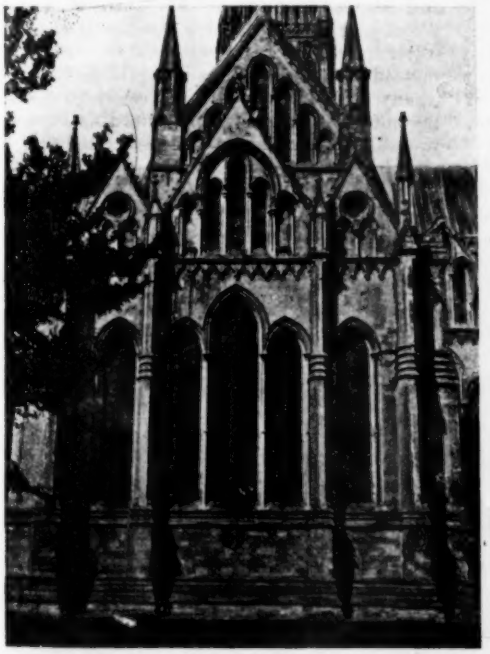


FIG. 33.—Grouped lancets in the east front of Salisbury Cathedral, 1250 A.D. The windows in the small gables show early tracery.

shape, which gives them their name of "Lancet Lights."[1] In the early part of the style they are very small, some little larger than archery-slits, and having the heads carved out of a single stone as in the Saxon period. But in later work they are sometimes six to ten feet long, and a foot to two feet in width. Especially in the east ends of churches, after 1220, three

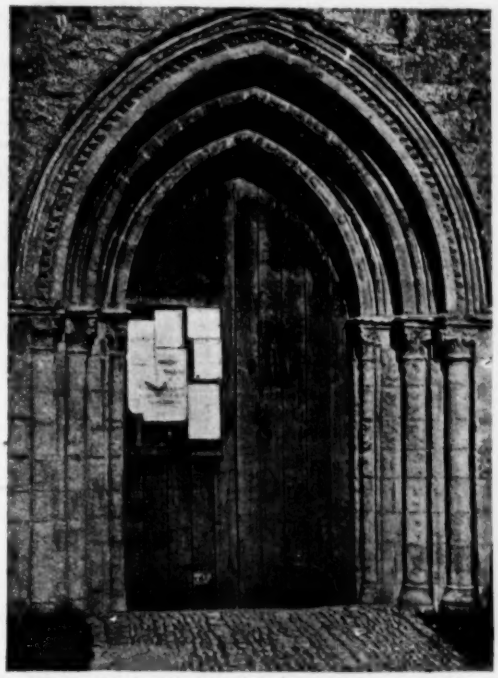


FIG. 34.—An Early English doorway, Hasely, Oxon, showing shafts in the jambs, with stiff-stalked foliage on the capitals and deeply cut hollows in the mouldings of the arch, with a suite of dog-tooth ornament in one of the hollows. 1220 A.D.

(or sometimes five or seven) lancet lights are grouped together, with a single dripstone over them. Such windows frequently form one composition within owing to the splay of the jambs. The grouping of lancet lights under one arch, and the piercing of the wall between the heads of the lights and the arch above, produced late in the style what is known as "Plate Tracery," which is the germ from which all the magnificent tracery of the later Decorated period was evolved. The evolution of the large many-light windows in late Gothic buildings may also be traced back to this grouping of lancets; the spaces between them may be seen to grow narrower and narrower till they are separated only by bars of stone. Mullions are thus of purely Gothic origin, and characteristic of that style of architecture only. The glass of the windows is set near the outer face of the wall, and externally the windows are usually very plain, in parish churches at any rate, in contrast to those of the preceding style. But within, the jambs are frequently enriched with shafts, and in late work there may be a double plane of ornament, with two shafts set one behind the other. Sometimes, however, there are shafts in the jambs outside as well. Late in the style, the arches of the lights may be foliated with cusps, making trefoils in the heads. The doorways have pointed arches, small doorways being, like the windows, long and narrow. Large doorways are

[1] Square-headed windows are found all through the Gothic style, but are not common in the Early English stage. Some arches are round, even after 1200 A.D., but their mouldings, the round abaci and foliage on the capitals, will distinguish them from Romanesque.

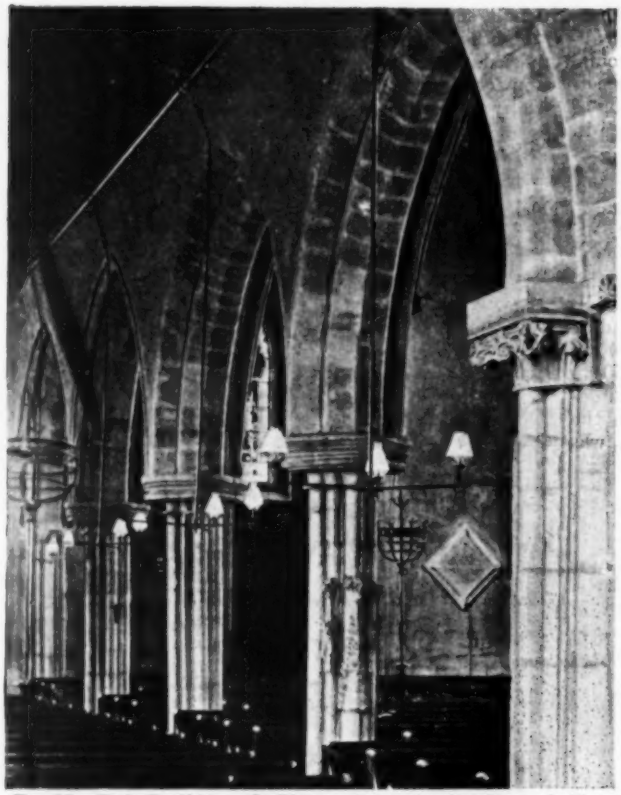


FIG. 35.—Early English arcade, Bicester, Oxon, showing clustered pillars, one capital enriched with stiff-stalked foliage, the others with mouldings. 1260 A.D. (The square abacus on the first capital is most unusual at this date.)

deeply recessed, and the jambs are filled either with mouldings or with shafts or both. The shafts in Early English doors, windows, and piers are generally distinguished by the fact that they are almost detached from the jambs to which they are joined only by the bases and capitals, and sometimes by a band in the middle. The mouldings in the jambs consist of rounds separated by deep hollows. The undercutting is very deep—deeper than at any other period, for the workman was realising and testing the possibilities of his new tool, and the deep cutting shows his delight in and mastery over it. The most common and typical enrichment in this style is a pyramidal form, made by four triangular leaves joining at their apices, and resembling slightly a canine tooth. It is known as the "Tooth" or "Dog-tooth" ornament. This is placed in the hollow mouldings, and is usually deeply undercut in a very skilful manner. The most beautiful ornament of the style is placed on the bell-shaped capitals of piers and shafts. It consists of carved foliage springing from the neck of the "bell," where it joins the pillar, the stalks of the foliage pressing close to the bell, till at the top each breaks into three leaf lobes, which curl gracefully downwards and outwards. This foliage is called "stiff-stalked," because the stems follow the line of the capital, but there is nothing else stiff about it. It is not copied from any individual leaf, but has all the beauty and grace of natural foliage. Its evolution may be traced through the rude knob of opening foliage of the late Norman capitals to the volute of earlier Norman work, and perhaps ultimately to the acanthus capital of the Corinthian order, though it is far more free, graceful, and natural than any foliage in Classic work. The columns themselves are much lighter than in Norman work, and in fine churches are formed of four or more slender shafts grouped round a central column, and attached to it by moulded bands. In small churches they are usually round, sometimes octagonal, and, in some arcades, round and octagonal pillars are used alternately. When the capitals are not carved with stiff-leaved foliage, they may be known by the round abaci and deep undercutting. The bases of the piers are distinguished as being "water-holding," *i.e.* water poured on them is held in the hollows instead of running off as it would do from those in any other style. The buttresses in this style become of structural value, affording support to the walls in resisting the thrust of the roof, and allowing lighter work. Their projection is equal to their width, and it usually diminishes by stages towards the top. Two buttresses are placed at a corner of a building, at right angles to each

FIG. 36.—Very early Decorated windows, showing geometrical bar tracery, with the small early cusps known as soffit cusps making trefoils in the heads of the lights. North Choir Aisle, Dorchester, Oxon. 1290 A.D.

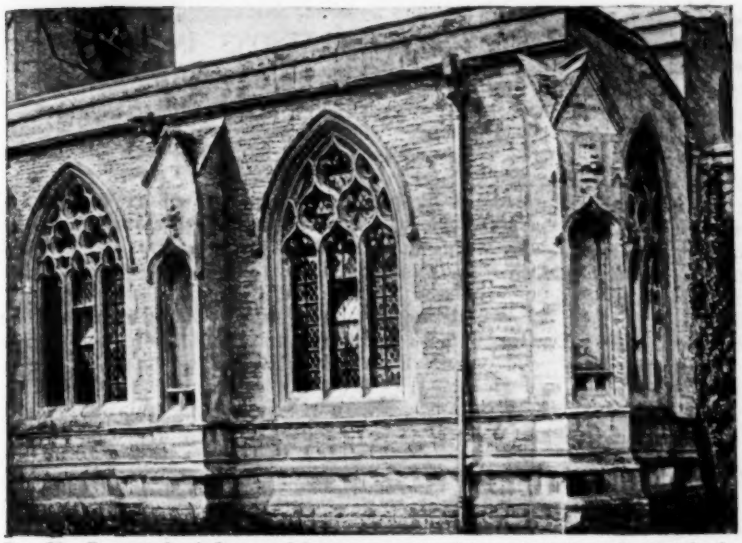


FIG. 37.—Decorated windows and buttresses, with niches which formerly contained images. Great Milton, Oxon, 1330 A.D. The middle window shows Flowing tracery of the kind known as reticulated or net-like. The ogee curves which give the wavy lines to the tracery should be noticed.

other and the walls. In the succeeding style, material was economised by placing one large buttress diagonally at the corners. The string-course running round an Early English building is much lighter than the Norman, and is deeply undercut. Early English towers are slighter and higher than Norman, and frequently terminate in spires, usually rather plain, sometimes with pinnacles at the base, though these are more common in the next style. Early English roofs are of more acute pitch than at any other period, the principle of verticality being most noticeable throughout the style.

THE DECORATED OR MIDDLE POINTED STYLE.

THE PERFECT GOTHIC, 1280–1380 A.D.

By the end of the thirteenth century, Gothic architecture had developed to such an extent (especially during the long reign of Henry III., who was an enthusiastic architect) that all its early massiveness had disappeared, and the narrow lancet windows also. From "plate-tracery" had been evolved "bar-tracery," in which the patterns in the windows were *built up* of stone bars—mullions, arches, and circles, instead of being *cut through* the solid wall. Thus, from about 1280, windows grow much larger, being composed of two, three, four, or more lights with tracery above. The stiff-leaved foliage, with its abstract natural beauty, is abandoned for carving from individual natural foliage, as of oak leaves with acorns, hawthorn, maple, the vine, etc. The carving is more profuse and even better executed. The ornamentation is very elaborate, a new enrichment, the "ball flower," is used, and new mouldings are carved on the jambs and arches. This, the culminating stage of the Gothic Style, is known as the Decorated Period. It must be borne in mind that the term is applied to a stage of development of a style and is not a style itself. The most easily distinguishable work of the period is the tracery of the windows. This, at first, being simply the development of Early English plate tracery, consists of geometrical patterns formed of curving bars of stone, in the head of the window above the lights. These patterns and the heads of the lights are cusped; the cusps being carved in one piece with the bars, and not fitted on to them, as was the case in the previous stage. This, the Early English method, is known as soffit cusping. By 1320, though geometrical tracery is still used, a further development known as "Flowing Tracery" is reached, in which the bars follow wavy lines, the heads of the lights have an ogee form, and the openings in the tracery of the window-head are irregularly shaped. The attention of the workman is centred on the lines of the tracery only, while in the Geometrical stage the workman attached equal importance to the forms of the bars and the openings alike. In some late examples of Flowing Tracery the lines have the sinuous upward curve of leaping flames,

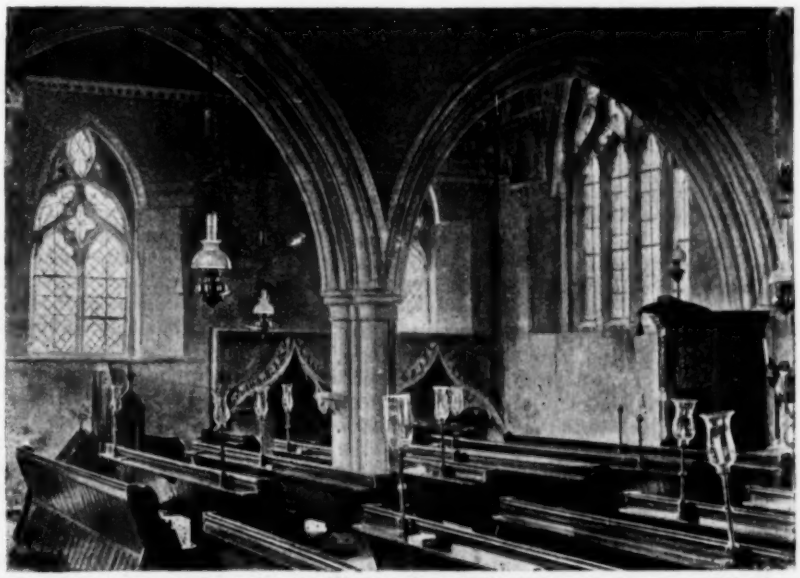


FIG. 38.—A Decorated interior, Ducklington, Oxon, 1350, showing Decorated mouldings on the arches and capitals, flowing tracery, and natural carving. A cornice of ball-flower may be seen on the wall of the aisle. The donors of the aisle are buried in the two canopied tomb recesses.

forming what has consequently been called "Flamboyant Tracery." Such windows, however, are rare in England but common in France, where they are the main characteristic of a distinct style—"The Flamboyant Style"—which was contemporary with English Perpendicular. Towards the end of the Decorated Period in England a flowing kind of tracery known as "Reticulated Tracery" becomes common, an example of which from Milton, Oxon, is shown by a photograph. The monotonous repetition of similar meshes all over the window-head shows failing design, and manual skill unaccompanied by *thought*, and hence is one of the earliest signs of the coming decadence of the Gothic Style. Some windows in the Decorated Style have square heads, and there are also many beautiful round "rose windows" of this period. The doorways of the style are much like those of the preceding one, but as the walls are thinner they are less deeply recessed. The hollows of the mouldings, too, are not so deeply cut, and the surfaces of the mouldings are wider. An ogee moulding now becomes common. The shafts in the jambs are curved on the stone, and are not detached pillars of marble or stone as in Early English doorways. This applies also to the shafts of the windows and the piers. The capitals of shafts and piers are frequently decorated with natural foliage which was originally coloured or gilt. The mouldings of plain capitals, like those of the door-jambs, are somewhat shallow, and ogee curves can usually be traced in them.

Decorated buttresses have a distinct character. They are placed diagonally at the corners of buildings, one doing thus the work of the two Early English buttresses. Their projection consequently is greater. They are often highly ornamented with crocketed pinnacles, and have canopied recesses in which images formerly stood. These niches are a very marked characteristic of the style. They are often seen in the wall over doors, and in the west fronts of churches above and between windows. Late in the period, too, outer walls are often decorated with panelling, *i.e.* patterns sunk in the face of the stone, but this is far more common in the following style, of which it is a characteristic feature.

Crockets, which are bunches of foliage curling backward, something like the head of a bishop's pastoral staff, though used in late Early English work are a distinct feature of the Decorated Style. They are used to ornament the sloping edges of pinnacles which surround the bases of spires in this period and in many other situations. Spires and pinnacles terminate in bunches of foliage called "finials." But the most common ornament of the style is a three-petalled flower forming a cup which contains a ball, and is hence known as the "Ball-flower Ornament." It is used with the greatest profusion in the hollow mouldings of doors, windows, niches, and indeed in any position in which it is possible to insert it. Another ornament common in some localities is the "Four-leaved Flower," a four-petalled flower somewhat resembling a clematis, used in the same situations as the ball-flower.

The Young Citizen.—We are pleased to welcome the appearance of this new monthly magazine for boys and girls. The accounts of events the anniversary of which occurs during the month are likely to stimulate the taste for history. The whole book is thoroughly instructive and interesting.

COURSE OF LESSONS IN DOMESTIC SCIENCE AND HYGIENE.

THE SENSES (*Continued*).

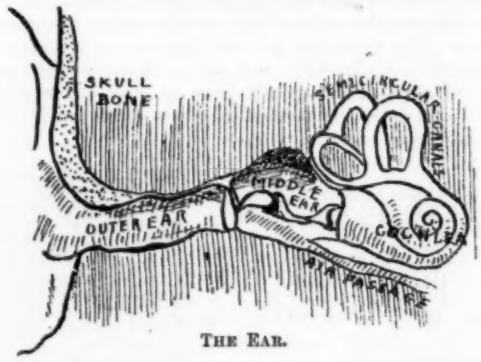
C. Hearing.

Step I. Preparation.—We have already seen how a distant object is able to affect the eye and the nose, but in order to understand the structure and action of the ear it is necessary to know something about the nature of sound and how it travels.

Sounds are caused by bodies which are in a state of more or less regular vibration: those bodies that vibrate regularly give rise to musical sounds, the others merely produce noise.

This may be shown by fastening the point of a needle to the end of a tuning-fork by means of a little wax, then, while the fork is sounding, drawing the point rapidly across a sheet of smoked paper. This line should be compared with the one produced by drawing the point across while the fork is not sounding; in the latter case we have a straight line, but in the former the line is wavy, showing that when the fork produces a sound it is in a state of vibration. As the fork vibrates backward and forward it sets up a series of waves which travel through the air in all directions, and it is these waves that enter the ear and give rise to the sensation of sound.

Step II. Presentation.—The ear consists of three parts—the outer ear, the middle ear, and the inner ear,



THE EAR.

which are separated from each other by delicate membranes. The *inner ear* contains three hollow tubes, called the *semicircular canals*, which are filled with fluid; these canals have nothing to do with the sense of hearing, but they lie in the three directions of space, and play a very important part in giving a sense of equilibrium or balance. Besides the semicircular canals, the inner ear contains a peculiar looking tube, which being twisted two and a half times on itself, has some resemblance to a small shell, and is on this account called the *cochlea* (snail-shell). In the cochlea are placed the nerve-ends which receive the vibrations and convey the sensation of sound along the *auditory nerve* to the brain.

The middle ear possesses three remarkably small bones, which are suspended by very delicate muscles in such a way as to form a chain by which the vibrations are conveyed from the outer ear to the cochlea. These bones are of very peculiar shapes, and are called by

names meaning the hammer, the anvil, and the stirrup, from their resemblance to those objects.

The outer ear consists of a winding passage, closed at one end by a membrane forming the "drum" of the ear, which readily takes up the vibrations of the external air, and passes them on by means of the hammer, anvil, and stirrup to the cochlea.

As any alteration of atmospheric pressure would be attended with serious consequences if it occurred only on one side of the drum, there is a passage leading from the throat to the middle ear which admits the air to the other side of the drum, thus equalising the pressure.

In addition to these three parts of the ear proper there is the broad cartilaginous flap forming the external ear, which from its fancied resemblance to a sea-shell is known as the *concha*.

Step III. Association. — It is interesting at this point to compare the human ear with those of the lower animals, most of whom have the sense of hearing remarkably well developed. Take the horse, for example. One cannot help being struck with the beauty of his ear; the concha is long and trumpet-shaped, so that it is able to gather in a large number of sound waves and lead them to the inner ear. The human ear is very inferior on this point, so people who are slightly deaf frequently place the hand against the ear, or in very bad cases use an ear-trumpet, the object in both being to enlarge the wave-gathering part of the ear. Another point in which the ear of the horse is superior to that of a human being is that the former is able to direct the opening of the outer ear in any direction, so as to catch the slightest sound waves coming from any particular point, whereas human beings have, with very few exceptions, entirely lost control of the muscles that move the external ear.

Step IV. Formulation.

1. Sound is caused by vibrating bodies, and is carried to the ear by a series of waves.

2. The ear consists of three parts, in addition to the external ear or concha:—

(*a*) The inner ear contains the semicircular canals and the cochlea.

(*b*) The middle ear contains a chain of bones, known respectively as the hammer, anvil, and stirrup.

(*c*) The outer ear is a winding passage closed by a membrane called the drum of the ear.

There is an air passage from the throat to the middle ear.

Step V. Application.—There are a few points in connection with the care of the ears which will be readily understood from these lessons:—

1. The ear is extremely delicate, and although the inner ear is placed in the thickest and strongest bone of the skull, it is easily injured. For this reason the common practice of "boxing the ears" must be strongly condemned, as it is liable to injure the ear or the brain itself.

2. Never poke anything hard into the ear, as it may rupture the drum.

3. The outer passage is protected by wax, which is secreted by glands. *This should never be removed* except by a medical man; if too much wax is secreted, and a little runs into the concha, this of course will be washed away; but do not poke anything into the ear itself.

4. Always keep the ears clean.

D. Touch.

Step I. Preparation.—The sense of touch differs from the other senses in that it is distributed over the whole body instead of being restricted to one particular organ. But although all parts of the body except the hair, nails, and teeth possess the sense of touch, they do not all possess it to the same degree, and it forms an interesting exercise to ascertain which parts are the most sensitive. This may be done by making experiments with the points of a pair of dividers and noting how far apart they must be before each of the points will produce a distinct and separate sensation. It has been found that the tongue can distinguish the two points when only one-twentieth of an inch apart, and the tips of the fingers when they are one-twelfth of an inch apart; but on the cheek they must be over one inch, and on the back over three inches apart before they will give more than one sensation.

Step II. Presentation.—The sense of touch is due to a layer of tissue made up of a network of nerve-fibres and blood-vessels closely interwoven. In those parts where the sense is very delicate, as in the tongue and the finger-tips, the nerve-fibres end in little knobs or papillæ, which give rise to the well-known ridges and elevations in those parts.

But although the sense of touch is due to this layer of nerve-fibres, in order to carry out its function properly it must be protected by a layer of epithelium or epidermis, otherwise contact with a body gives rise to a feeling of pain and not to the sense of touch properly so called.

Step III. Association.—The sense of touch may be regarded as the parent of all the other senses, for we find that the very lowest forms of life possess this sense, although they may possess no other. As these low forms of animal life gradually developed, so the sense of touch developed, and instead of being distributed all over the body alike and merely being able to distinguish between contact with bodies that were hard or soft, rough or smooth, etc., certain parts developed this sense in some particular direction so that they became sensitive to contact with such delicate exciting causes as the waves of light or of sound, or with minute particles possessing odour or taste, and thus the other senses of sight, hearing, smell, and taste were evolved from the sense of touch, each possessing its own particular organ or organs.

Step IV. Formulation.

1. The sense of touch is distributed all over the body, but is more delicate in some parts, such as the tongue and finger-tips, than in others.

2. It is due to a layer of nerve-fibres.

3. In parts where the sense is very delicate these fibres terminate in papillæ.

4. The nerves must be covered with epidermis, otherwise contact with them merely causes pain.

5. The other senses are highly developed forms of the sense of touch.

Step V. Application.—The sense of touch can be cultivated quite as much as the other senses; the blind can ascertain things with their fingers that a person with sight is quite unable to distinguish. This, however, is not the result of a special gift of Providence, but simply of constant use.

General Application of these lessons on the senses.

We have seen how the sense of touch has been

developed in certain parts of the body, and has given rise to other senses having their organs in those parts, but this process of development or evolution is not complete and unalterable. It is most important for us to remember that there is no such thing as standing still in the process of evolution; we must either go forward and improve, or else we shall begin to deteriorate. Most people recognise that the muscles can be developed by use and exercise, but they overlook the fact that the senses can be developed in the same way, and of the two the development of the senses is the more important.

If we only consider our success in life, which is, of course, regarding the matter from its lowest point of view, it is the individual whose senses are developed and trained that leads the way in every walk of life, for the critical eye of the artist or designer, the delicate ear of the musician, or the skilful touch of the surgeon are to a great extent the result of training, and not accidents of birth. But the cultivation of the senses brings a higher reward even than material success, for it enables us to enjoy some of the highest pleasures that this world affords; to the uncultivated senses the glorious sights and sounds of Nature are as a closed book, and the only pleasures they can appreciate are those, such as eating and drinking, which are shared by the brute creation.

TEACHING NOTES ON "THE HISTORY OF LONDON."

D.—LONDON A HUNDRED YEARS AGO AND THE LONDON OF TO-DAY.

I. London in 1801.

1. Population and Area.

(*a.*) Less than a million—958,788.

(*b.*) Area a little over 9½ square miles. [Cf. II. 1.]

2. Food and Taxation.

(*a.*) Towards the close of the eighteenth century food was dear and scarce, and taxation heavy and oppressive owing to the war with France.

(*b.*) In 1792 wheat could be purchased for 42s. a quarter; in 1800 it rose to 133s., and a quartern loaf was sold for 1s. 10d.

(*c.*) Other commodities were equally dear: beef, 1s. 6d. per lb.; mutton, 1s. 3d. per lb.; fowls, 6s. 6d. each.

(*d.*) Four million pounds were expended in the relief of the poor in England and Wales in 1801.

(*e.*) Every conceivable thing was taxed: foreign wheat, newspapers, salt and other articles of food, windows, etc.

"The schoolboy whips his taxed top; the beardless youth manages his taxed horse with a taxed bridle on a taxed road; and the dying Englishman, pouring his medicine which has paid seven per cent. into a spoon which has paid fifteen per cent., flings himself back on his chintz bed, which has paid twenty-two per cent., and expires in the arms of an apothecary who has paid a licence of one hundred pounds for the privilege of putting him to death" (Sydney Smith).

3. Crime and Punishment.

(*a.*) Crime was rampant; it was almost impossible to walk down a street in the daytime in certain places without being assaulted or molested; after dark, matters were worse. This state of affairs was due to the absence of an effective police force.

(*b.*) The police, who were called "Charlies," were decrepit and feeble men, armed with a stout cudgel and supplied with a watch-box. They called out the hours of the night and the state of the weather.

(*c.*) Punishments were barbarous, and inflicted with the utmost rigour. Capital punishment was inflicted for trivial offences, *e.g.* house-breaking, stealing an article valued at 5s. or more, burglary, stealing a horse, a coat, or a lamb. The law recognised 223 capital offences.

"A man might be hanged for almost anything: if he appeared in disguise on a public road; if he cut down trees; if he shot rabbits; if he poached at night; if he stole anything worth five shillings from a person or a shop; if he came back from transportation before his time; a gipsy, if he remained in the same place a year. In fact, the chief desire of the Government was to get rid of the criminal classes by hanging them" (Besant's *Fifty Years Ago*).

(*d.*) In the Army and Navy severe punishments were inflicted. Flogging was the usual mode of punishment. In one case a soldier was sentenced to 1000 lashes, 750 of which were actually administered.

(*e.*) Prisoners were herded together—men, women, and children.

(*f.*) Debtors were sent to prison, where they were compelled to associate with criminals of all grades; many were never released.

4. Manners and Customs.

(*a.*) Morality was at a very low ebb; manners were coarse and rude.

(*b.*) Drunkenness was common amongst high and low.

"Drunkenness was almost universal; a dinner party was regarded as a failure if the guests did not drink deeply, and it was considered no disgrace—on the contrary, it was regarded as the proper thing—for those who could quaff no more to seek that repose on the floor which the seat at table failed to afford" (*Life of a Century*).

(*c.*) Profane swearing was indulged in.

(*d.*) The inmates of lunatic asylums were frequently flogged and starved. George III. himself was flogged during his fits of insanity.

(*e.*) Little boys and girls worked in factories, and boys were employed to climb chimneys to sweep them. The little chimney-sweep had to work naked, and often had to climb chimneys that were on fire, to the great danger of life and limb. Even young girls were sometimes employed in this occupation.

"In stench, in heated rooms, amid the whirling of a thousand wheels, little fingers and little feet were kept in ceaseless action, forced into unnatural activity by blows from the heavy hands and feet of the merciless onlooker, and the infliction of bodily pain by instruments of punishment invented by the sharpened ingenuity of insatiable selfishness" (*History of the Factory Movement*).

5. Amusements and Sport.

(*a.*) Cruel and degrading sports were exceedingly popular. The general forms were bull-baiting, prize-fighting, and cock-fighting.

(*b.*) Great fairs were held at Smithfield on St. Bartholomew's Day, and at Greenwich at Whitsuntide. Shows and merry-makings were the attractive features.

(*c.*) Numerous tea-gardens existed. The most fashionable were those at Vauxhall and Ranelagh (Chelsea), both of which were well patronised.

(*d.*) There were only eight theatres, the most important being Drury Lane and the Theatre Royal.

6. Travelling.

(*a.*) In 1801 the journey from Edinburgh to London occupied eighteen days, and was performed by means of stage coaches.

(*b.*) Other modes of travelling were sedan-chairs, post-chaises, and the river.

(*c.*) No railways existed, for it was not till 1801 that an Act of Parliament was passed for the construction of a railway from Wandsworth to Croydon.

(*d.*) There were only three bridges across the Thames—London Bridge, Westminster Bridge, and Southwark Bridge. As a toll had to be paid on the last, it was seldom used.

(*e.*) The river was the favourite highway. "Thousands of boats plied up and down: it was much safer, shorter, and more pleasant to take oars from Westminster to the city than to walk or hire a coach" (Besant).

(*f.*) The streets were badly lighted with flickering oil lamps, which were extinguished by a gust of wind.

(*g.*) London at this time was regarded as the best paved city in the world!

7. Newspapers.

(*a.*) Newspapers were a luxury. They were few in number, small in size, and exorbitant in price. The *Times*, the *Morning Post*, the *Morning Chronicle*, the *Morning Herald*, and the *Morning Advertiser* were the leading London papers.

(*b.*) The *Times* cost 7d. a copy, and the others about a penny less.

(*c.*) A tax of 2½d. was imposed on every newspaper. [This was raised to 3½d. in 1803 and 4d. in 1815, and 3s. 6d. on every advertisement.]

8. Social Facts.

(*a.*) Lucifer matches had not yet been invented. A light was obtained by means of a flint, a piece of steel, and a piece of tinder.

(*b.*) A letter transmitted through the post cost from 8d. to 1s. 6d., according to the mileage.

(*c.*) Shops had no large plate-glass windows, but thick tiny panes set in small bow windows.

(*d.*) Candles were the artificial light in common use.

(*e.*) Pall Mall was lighted by gas in 1807. [Gas came into general use in 1816.]

II. London in 1901: A Contrast.

1. London in 1901.

(*a.*) Area 121 square miles; largest city in the world.

(*b.*) Population of London—5,000,000 (1901).

(*c.*) Population of Greater London—6,580,616 (1901).

(*d.*) Capital of the British Empire.

(*e.*) Monetary capital of the world.

(*f.*) A centre of art, literature, and science.

(*g.*) One of the healthiest cities in the world.

2. Improvements during the Century.

(*a.*) Capital punishment only inflicted for deliberate murder.

(*b.*) Better modes of transit—railways, omnibuses, trams (horse and electric), cycles, motor cars, etc. Communication now very easy and rapid.

(*c.*) Education within reach of all. There are excellent newspapers, public libraries, and many other institutions for the advancement of knowledge.

(*d.*) Improved conditions of labour. No child under ten years of age is allowed to work in a factory. The wages of the worker are better; his food is cheaper; he lives in a better house; he has the right of public meeting; he possesses a vote, etc. [In 1824 the laws forbidding the formation of trades-unions were repealed.]

(*e.*) Food cheap and plentiful.

(*f.*) Greater spirit of humanitarianism prevalent.

(*g.*) More refinement—cruel sports have disappeared, press-gang abolished, hanging not performed in public, etc.

(*h.*) Admirable police force.

(*i.*) Streets improved; well lighted.

(*j.*) Improved sanitation.

THE CAPE-CAIRO RAILWAY UP-TO-DATE.

BY WALTER H. BREEZE, F.R.G.S.

THE chief feature of the will of the late South African millionaire, Mr. Beit, was the bequest of £1,200,000 for the promotion of means of communication in such parts of Africa as may be traversed in establishing what is known as the Cape-Cairo Railway.

"I believe," says the testator, "that by the promotion, combination, and furtherance generally of railways, telegraphs (including wireless telegraphy), telephones, and kindred or other methods of transmission of persons, goods, and messages, civilisation will be best advanced and expedited in Africa for the benefit of the inhabitants thereof, whether native or immigrant, and I know from experience how difficult it is at times to find the funds for the construction of such methods of transmission in new and undeveloped countries."

The rapid increase of Rhodesian railways during 1905 and the present year suggests that little difficulty has been experienced in the provision of the necessary funds. It is now possible to travel by train from Cape Town, through Southern Rhodesia, to the Port of Beira in Portuguese East Africa, a distance of over 2000 miles, while the main line is now open for traffic to a point 330 miles north of the Zambesi. Some 260 miles north of the Victoria Falls a fine bridge 1600 feet long has been constructed over the Kafue River. Sir William Milton, Administrator of Southern Rhodesia, has recently visited this district, and reports that the river is navigable up-stream for 250 miles from the railway bridge. The Rhodesian Railways are accordingly arranging for a service of sailing boats, in order

to collect native produce and bring it to the railway. Beyond the Kafue River the line has been constructed some 70 miles to the Broken Hill Zinc and Lead Mines. The line is said to be progressing at an abnormal rate, for, on a recent occasion, 5¼ miles of rail track were laid in ten hours. A survey of the district beyond Broken Hill has been made, and it is probable that the next section will go due north to Bwana Kubwa Mine, a point on the Congo border and the centre of a rich copper area in North-west Rhodesia.

STATUE OF MR. RHODES AT BULAWAYO.
(By permission of British South Africa Co.)

A light railway has been built from Salisbury to the Ayrshire Mine, and is to be extended to Eldorado, and it is a remarkable fact that at the present time every mine of importance now at work in Rhodesia is within a few miles of a line of railway.

The Beira Railway.

The shortest railway route to Rhodesia is from Beira, a rising port on the coast of Portuguese East Africa. The railway passes through Umtali to Salisbury—a distance of 374 miles as compared with 1663 miles from Cape Town. The voyage from England to Beira (western route) occupies about thirty days; but the journey may be completed in twenty-three days by steamers of the German East African Line per Suez Canal route. There is a bi-weekly rail communication between Beira and the principal trading and mining centres of Rhodesia — Umtali, Salisbury, Hartley, Gwelo, Selukwe, Gwanda, and Bulawayo.

The journey from Beira to Salisbury occupies thirty-two and a half hours, and in a further twenty-four hours passengers arrive at Bulawayo, from whence they may travel northwards to the Victoria Falls or southwards to Kimberley and Cape Town.

As the Beira Railway was only completed in 1902, the rolling stock is of an up-to-date character. The carriages are of the corridor type, similar to the latest type used on English railways, and run on bogie movements. All trains are composed of first, second, and third class, and are provided with sleeping and lavatory accommodation. The railway fare from Beira to Bulawayo is:—First class, £9, 14s. 3d.; second class, £6, 9s. 4d.; third class, £3, 4s. 11d.

The Victoria Falls Bridge.

To the founder of Rhodesia belongs the honour of the conception of the idea of a great railway bridge which should span the Zambesi gorge near the Victoria Falls. "Build the bridge across the Zambesi where the trains, as they pass, will catch the spray from the Falls," was the command of Mr. Cecil Rhodes, and in 1900–1 a survey of the proposed site was made, a preliminary design prepared, and the work commenced with that zeal and enthusiasm so characteristic of the great empire-builder.

While Boer and Briton were gripped in a death struggle in the southern part of the continent, railway construction in Rhodesia was being pushed forward with energy and determination, undismayed by the fortunes of war or rumours of catastrophe.

At a place where the river is over a mile in width,

the Zambesi is suddenly precipitated into a yawning abyss, over 400 feet deep, and the whole volume of water forces its way into a narrow trough banked by high cliffs for 40 miles, until it again widens out into a broad and tranquil river.

The Victoria Falls are twice as broad and nearly two and a half times as high as the Falls of Niagara, and present a remarkable and unparalleled sight at all seasons of the year. Distinguished travellers have referred to the Falls as the finest natural spectacle in the world. Mr. Archibald Colquhoun, who visited the Falls last year, writes:—"If the earth can show any sight more dramatic, majestic, or sublime in its suggestion than this, then I have not seen it, and yet it has been my lot to see most that is held to be fairest in the two hemispheres."

The bridge crosses the gorge 500 yards from the cataract, at a point where the width is 650 feet at the upper level, and where, for several weeks at the close of the wet season, it is covered with spray which descends upon it like a heavy rain. Thus the originator's dream has been realised, and fancy converted into actual fact. The design of the bridge is simple, bold, and effective. The main arch is a graceful parabolic curve, and has a span of 500 feet. The truss of which it is composed is 15 feet deep at the centre and 105 feet at the springing. The rise of the arch is 90 feet. The continual painting of the bridge is being performed by natives under European supervision, and it is remarkable how the native follows the white man's lead, for prior to the advent of the railway there was not a native living within 60 miles of the Falls, owing to the superstitious dread of the evil spirit which was supposed to haunt the locality.

The engineers of the bridge were Sir Douglas Fox and Co., and the contractors the Cleveland Bridge and Engineering Co. of Darlington. These British firms have erected in the heart of Africa as fine a piece of steel construction as can be found anywhere in the world.

Rhodesia's Progress in 1905.

Rhodesia is developing very rapidly and overcoming the difficulties inseparable from the cutting of its communications during the war. Distance is being annihilated, for the journey from Southampton to Bulawayo can now be performed in twenty-one days, and Matabeleland figures to-day as a tourist centre. Groups of Europeans and Americans may be encountered gazing with wonder on the Victoria Falls, examining with curiosity the Zimbabwe ruins, and visiting the lonely grave amidst the gigantic boulders of the Matoppos.

The progress of the country during 1905 has in many respects been more marked and more important than in any previous year of its history. The mineral output has placed the country in the front rank of mineral producers. The output of gold during the first nine months of the year was 303,688 ounces—an increase of 35,951 ounces over the whole of 1904. In addition to gold the output of silver reached 70,000 ounces; lead, 450 tons; and coal, 70,000 tons. In stock rearing and agriculture similar progress is noticeable, and a healthy activity prevails among the farming community. Tobacco grows well everywhere, and there is a big field for enterprise in this line of agriculture. At Bulawayo and Salisbury some excellent Turkish tobacco has been grown, and Rhodesian cigarettes may now be purchased in London. Experimental cotton planting has proved that in Rhodesia the plant may be grown successfully as a perennial, whereas in America it can only be grown successfully as an annual.

THE MARKET HALL, BULAWAYO.
(By permission of British South Africa Co.)

Maize, or Indian corn, is the staple cereal product of Rhodesia at the present time, and remunerative prices are readily obtained.

Wheat grows well and yields abundantly in many parts of the country, and its cultivation is being extended since Rhodesian wheat has received such favourable notice on the British corn markets.

Sheep and goats thrive remarkably well all over Rhodesia, and the introduction of merino-wooled sheep has proved a great success.

The prevalence of horse-sickness has prevented horse or mule breeding to any great extent, but investigations by Dr. Koch has convinced him that a simple process of immunisation is possible, much on the lines of his process for inoculation against rinderpest, by which means South Africa has rid itself of that disease. If the system of inoculation against horse-sickness is proved to be as successful as anticipated, there will be a great future for horse-breeding in Rhodesia.

NOTES ON AN EXPERIMENTAL COURSE OF LECTURES ON PLANT LIFE AND SOIL.

BY EDWARD J. RUSSELL, D.SC. (LOND.),

Lecturer in Chemistry, South-Eastern Agricultural College, Wye.

(*Continued from p.* 196.)

Evaporation of Water from the Soil.

Influence of Crop. Experiment 84.—Fill two lamp glasses with soil, which must be kept in by tying calico round the bottom of each glass. Place in separate beakers of water; after two or three days, when rapid absorption has ceased, refill the beakers to the same height, and mark the water level by gummed paper. Then sow seeds in one glass, and leave the other uncropped. As water evaporates from the soil surface more is drawn up from below, the water level in the beakers therefore sinks. It will be found that the vessel in which the seedlings are growing loses more water by evaporation than does the other, and the water level in the beaker falls at a more rapid rate. About a week is necessary to show a clear difference.

Experiment 85.—The following piece of apparatus shows the same thing very well. Select a cork to fit one end of a lamp glass, put through it a glass tube bent in the form of a J, then replace in the lamp glass and make the union more complete by the application of Faraday's cement. The longer limb of the J should be outside, and should be parallel to the axis of the glass. Fill with soil, run in water, and after a few hours, mark the level of the water in the glass tube which is to act as a water gauge.

Make another of these, and proceed as in the above paragraph. Then sow seeds in the soil. After a time germination takes place, and growth begins, when it is found that the rate of evaporation is more rapid in the cropped than the uncropped tube.

This apparatus is more sensitive than the one given in Experiment 84, and shows a difference in twenty-four hours. It is, however, rather liable to leak.

Influence of Mulching.—A "mulch" is a layer of dry soil, leaves, cut grass, or other vegetable matter spread on the surface of the soil.

Experiment 86.—Use two tubes, either as in Experiment 84, or as in Experiment 85, cover the surface of the soil in one with a mulch of cut grass, and leave the other bare. Notice that evaporation is more rapid from the latter than from the former.

Influence of Temperature. Experiment 87.—Take two more tubes, paint one black and the other white, leave in sunlight, and observe that evaporation goes on more rapidly in the black than in the white tube. Compare with Experiment 93 below.

The Soil in its Relation to Temperature.

The direct source of heat is the sun, but such indirect sources as warm winds and warm rains play an important part in determining soil temperature, especially during spring time. It is scarcely possible to regulate the supply of heat, but one can, without much difficulty, regulate to a certain extent the amount of heat absorbed by the soil, and the way in which this heat is used. One of the main factors is the percentage of water in the soil. The specific heat of dry soil is only about one-fifth that of water, and it is obvious that a wet soil requires a much larger supply of heat to produce a given rise of temperature than is wanted by a dry soil. On the other hand a dry soil will lose its heat more rapidly than a wet one. Dry soils, therefore, warm up quickly in spring and produce early crops; they cool quickly in autumn, consequently growth soon ceases, and crops are not always heavy. Moist soils do not give early crops, but they retain their heat for a longer period, growth is prolonged, and heavy crops can be produced.

These relationships can be demonstrated by indoor experiments, but it is much better to do experiments out of doors in the school garden.

Plot Experiments.

Water contained in the soil. Experiment 88.—The percentage of moisture in the soil is obtained by digging out with a trowel a cylindrical mass about 5 inches in depth and 3 or 4 inches in diameter. This is weighed, spread on a tray, and left exposed to the air indoors for a few days, then weighed again. The loss of weight is assumed to represent the free water present in the soil.

Should the school balance not carry a large weight, it will be necessary to spread out the soil as quickly as possible after it has been taken, and draw a small representative sample, with which the determination is to be made.

Effect of hoeing and mulching. Experiment 89 (for summer or early autumn).—Measure out a piece of ground 3 yards by 1 yard, and divide into 3 plots each 1 yard square. The central plot is to be left untouched, one of the outer ones is hoed daily, the other is mulched with a layer of dry grass. After a week determine the percentage of moisture. During dry weather it will be found that the untouched plot contains least water and the hoed plot most. In the experiment carried out in the Wye school garden the percentages of moisture after one week's dry weather were:—

Untouched plot . . .	8·38
Plot mulched with grass .	8·84
Hoed plot	12·22

In a depth of 6 inches this amounts to an excess of about 14 lbs. of water per square yard in the hoed plot over the amount present in the untouched plot. (Compare Experiment 86.)

Effect of winter cultivation. Experiment 90 (for winter and early spring).—Take two plots, each 2 yards square and separated from one another by a path, beat one down in autumn or winter, dig the other as deeply as you can. Leave for some weeks till a fair amount of rain has fallen, then determine the moisture present. A Wye experiment showed:—

Untouched plot . . .	15·4
Deeply dug plot . . .	19·5

Effect of cropping. Experiment 91 (for summer or early autumn).—Determine the amount of moisture in a piece of cropped ground or immediately under a hedge, and also in a piece of uncropped ground. The latter will be found to be much richer in water than the former. (Compare Experiments 84 and 85.)

Temperature of the soil.—This is determined by inserting a thermometer 2 or 3 inches in the soil. The precise depth is not material, but it must be as exactly as possible the same for all plots.

Effect of slope. Experiment 92.—Make a ridge about 2 feet high and running E. and W. so that one face fronts the south and the other the north. After a few hours take the temperature on each face. At Wye in August the temperatures were 23° on the south side, 20° on the north side, although the slope was made so that the sun could shine on the northern face.

Effect of colour of soil. Experiment 93.—Set out three adjoining plots, each 1 yard square, leave the centre one untouched, cover one of the outer ones with lime and the other with soot. Take the temperatures. The black soot increases the absorption of heat, and there is a rise of temperature; the white lime causes some rays to be reflected, decreases the absorption of heat, and causes a lowering of temperature.

Plots at Wye last August gave the following results:—

Limed plot	18°
Untouched plot . . .	21°
Sooted plot	22·5°

Market gardeners often apply soot early in the year to their land; besides its manurial value there is also an increased absorption of heat at the time when extra warmth is much wanted.

Effect of hoeing and mulching. Experiment 94.—Take the temperature of the plots in Experiment 89. Hoeing and mulching in summer bring about a decrease in temperature. The results of some of our experiments were:—

Untouched plot . . .	21°
Hoed plot	18·5°
Mulched plot	19°

Effect of water content. Experiment 95.—This requires a wet, undrained, or marshy piece of ground, which is not always obtainable. Wet land is, as a rule, cooler in spring and summer, but warmer in winter than dry land.

Effect of shade. Experiment 96.—Take the temperature of a piece of cropped land—which is therefore shaded, and of some uncropped land. In summer the latter is found to be warmer than the former.

THE WEST RIDING JUDGMENT.

We are officially informed that the Government has decided to appeal in the matter now commonly spoken of as the recent West Riding udgment. We understand that this decision is due to the necessity which exists for clearing up, if possible, some of the numerous points of difficulty which have arisen consequentially upon the judgment. It appears that, owing to the particular form of the judgment, local authorities find themselves in great doubt as to whether certain forms of expenditure will or will not now be legal, and several difficult issues are inevitably raised in addition to the one specific point that was alone decided, technically speaking, by the judgment. Both the Board of Education and the Local Government Board have been appealed to by local authorities in all parts of the country for guidance or advice; and, as neither of these departments has any authority to pronounce on the matters in question, local authorities' administration is in danger of drifting into chaos, and individual members naturally fear surcharge. It has thus become imperative to endeavour to have the whole matter cleared up in its various ramifications, with as little delay as possible.

COMMON-SENSE NEEDLEWORK.

BY MISS FLEMING,

Authoress of "How to Teach Needlework," "Pupil-Teachers' Needlework," "Sewing-class Guides," etc.

PATCHING IN CALICO.

PREPARATION.—Lined cutting-out paper, pencils, needles and cotton, and one correctly worked specimen between two girls.

The teacher will provide herself with coloured chalk and a large sheet of cutting-out paper to represent both the article to be patched and the mending material.

Information and Suggestion.

When the defective part of a garment has got beyond darning, it is better to cut it out and insert fresh stuff in the form of a patch. This should replace as near as possible the worn fabric. It is advisable to mend with old material rather than new.

The lines on the paper will form a guide for the cutting. The patch may be either square or oblong.

It must be the same way of the material as the garment, otherwise it will not lie flat or look neat.

The cutting must be clean and straight, without jagged edges. To secure this make a sweeping incision without allowing the points of the scissors to meet.

The specimen exercises should be examined by the girls that they may find out for themselves whether the *fell* is formed by the patch or by the garment, as both methods are used. The former answers better for teaching purposes and for ordinary repairs. It looks neater than the latter, for all the worn part is cut away from underneath, and only a very narrow fell is left round the seamed square formed by the patch.

First Method.

Fixing in Paper.—Each step is to be demonstrated by the teacher and then copied by the class.

Pin the sheet of paper on the blackboard.

Cut a hole near the top.

Draw lines round the hole on every side about one inch from it with coloured chalk.

This square includes the thin part which usually surrounds a hole. It shows where the seaming stitches will come, and thus is the exact size of the completed patch. It will in future be termed the "Patching Area."

Cut off from the lower end a square of paper large enough to cover this space and as much larger as will allow for turnings.

Crease the "patching area" diagonally.

Place this on the desk with the right side upwards.

Crease the patch also from corner to corner.

Lay a narrow turn on the *right* side of the patch, folding the selvedges first.

Draw the attention of the class to the width of the fell on the specimens, which gives the depth of the second fold to be made round the patch.

Make the second fold, which forms the fell, by turning it backwards so that it falls on to the wrong side of the patch.

Too deep turnings make the work look clumsy. At the same time they must be deep enough to render the

seam firm and strong. If they are not flat and even, the appearance of the work is spoiled.

Lay the fixed patch wrong side upwards over the cut hole matching the diagonals and making the lines

CALICO PATCH (FIRST METHOD).

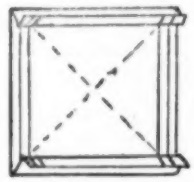


FIG. 1.—Preparation of Patch, Wrong Side.

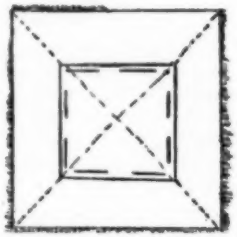


FIG. 2.—Patch tacked on Garment.

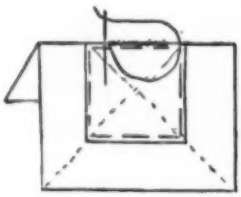


FIG. 3.—Right Side of Patch.

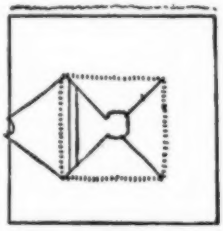


FIG. 4.—Wrong Side.

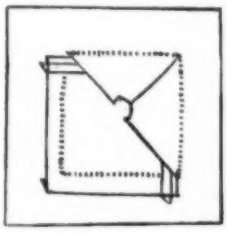


FIG. 5.

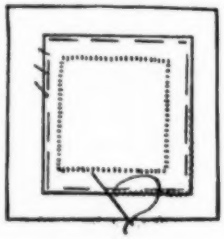


FIG. 6.

on the paper, which correspond to the selvedge way of the material, all run in the same direction.

Tack it firmly.

The great advantage of lined cutting-out paper is that the right and wrong sides, and the selvedge way, being so clearly indicated all attention can be devoted to the fixing.

Fixing in Calico.—The lesson should be repeated, the class being supplied with calico instead of paper. The teacher's demonstration specimen should be a large calico patch seamed but not cut out underneath.

It is very necessary that the right and wrong sides, and the selvedge way of the material should be found.

Pins placed in the lower corners will indicate both.

When the patch is cut off the pins will remain to show exactly how it should be placed.

It must be fixed as described above, and tacked exactly along the *warp and woof threads* over the hole cut for the purpose.

Sewing the Patch.—Teachers usually find it better to commence seaming in the middle of a side, but that is a matter of individual opinion and not of vital importance.

Commencing.—A beginning is made by putting the needle backwards between the two folds and leaving a piece of cotton hanging out.

This is held firmly by the thumb of the left hand until a few stitches are made, when the end can be tucked in between the folds.

Having drawn special attention to the fact that if more than the upper thicknesses are taken up at the corners the fell will not flatten out, the class may proceed with the seaming, the teacher meanwhile noting each girl carefully from the front.

Finishing off.—When nearing the end of the seaming, the class must be told how to fasten off. This is done by sewing over four or five stitches and by *cutting* the cotton off close. If the thread be broken off, some of the stitches may come undone.

Stroke the seaming well.

Exhibit the underside of the specimen, showing the hole in the "patching area" surrounded by a square of seaming stitches.

Put the point of the scissors into the hole and cut up to the four corners (Fig. 4).

There are now four triangles.

Cut each off, leaving raw edges of one-eighth of an inch from the corner. This discloses the fell which has been hidden underneath (Fig. 4).

Draw out the fell and flatten it.

Turn the fell over and stroke it thoroughly, especially the corners.

Complete the exercise by hemming the fell.

Let the felling stitches correspond in size and distance apart with the seaming stitches.

SECOND METHOD.

This time the *garment* forms the fell, which is hemmed down on to the patch.

Cut off the patch as in the former lesson.

Crease both patch and patching area diagonally.

Lay a *single* fold all round the patch on the *right* side.

Pin it in position over the hole on the *wrong* side of the work.

Tack it securely.

Hem it all round (Fig. 1).

I find it better to do this before turning the garment over and cutting out the underneath part.

I know that this plan is not always advocated, but when a large or awkward patch has been prepared on the wrong side, it often gets disarranged in turning the garment inside out. Besides, the hemming stitches thus produced form a better guide for the cutting-out of the under-part than tacking stitches would do.

Turn the work over to the right side.

Cut the lines diagonally from the hole to the corners. This time the cutting is not to be taken quite so far up, as both the fell and turnings are to be left.

Dots may be placed on the diagonal lines to indicate how far the cutting is to extend (Fig. 2).

Cut straight lines from dot to dot.

Make a snip at each corner to allow for the turning in of the edges (Fig. 3).

Make small turnings round the square.

Crease the material to meet the folded edge of the square, and hold the patch towards the worker (Fig. 5).

Complete by seaming (Fig. 6).

This method is eminently suited for mending sheets when a very large extended surface is thin.

The worn part under the patch is frequently not cut away, but remains, further strengthening the article.

CALICO PATCH (SECOND METHOD).

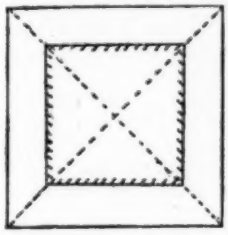


FIG. 1.—Patch Hemmed, Wrong Side.

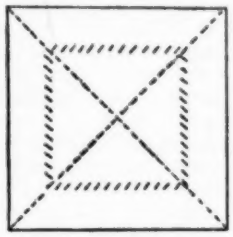


FIG. 2.

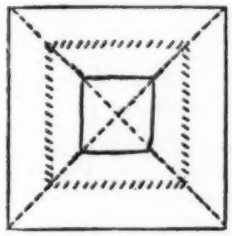


FIG. 3.

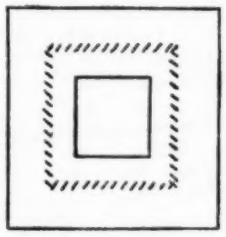


FIG. 4.

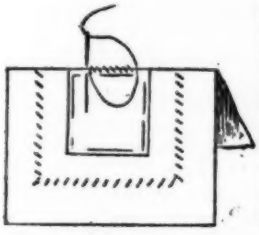


FIG. 5.

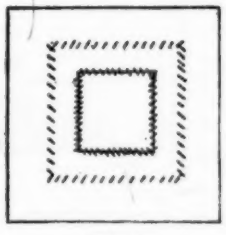


FIG. 6.

This will be more clearly shown in the sheet-mending lesson.

PATCHING UNDER-GARMENTS.

The straightforward fixing and working of a calico patch having been taught, all subsequent practice should be gained by the application of that exercise to some article of clothing. Putting a patch on a worn garment is a very different thing from working a neat little square on new calico.

The method of accomplishing this should be taught by means of blackboard illustrations, followed by an actual demonstration lesson.

The blackboard illustrations should be drawn, however roughly, *before the class*. They will represent the various parts of garments that wear out soonest, such as the under-part of the arms in chemises and the part near the knee in drawers.

The diagrams are easily reproduced.

The power to draw these and similar ones is absolutely necessary for class teaching; for a simple sketch executed in sight of the pupil is much more effective than an elaborate drawing prepared beforehand.

The fundamental principle of repairing is that all patches run with the warp and weft of the material.

No mending is properly executed that does not fulfil that condition. That is easy to grasp when inserting a square of new calico, but it is a very different matter in a garment gathered or pleated, that has stood hard usage and washing, for the almost inevitable tendency is to make the patch run with the lines formed by the wearing of the garment.

Figs. 1 A and B show the lines drawn wrongly, because they slope with the garment and do *not* run with the warp and weft.

Figs. 2 A and B give the correct position.

Much useful miscellaneous information can be imparted in such a lesson, *e.g.* in Fig. 5 A, a new sleeve would give a better result than a patch, while if *both* the sleeves were very badly worn, a fresh top contrived from the bottom of another half-worn chemise would be more satisfactory still.

Having taught the shape the patch will take when a garment is repaired, the next step is to show how to do it, which is the demonstration lesson.

REPAIRING CHEMISES.—A.

FIG. 1.—Wrong Method of Placing Patch.

FIG. 2.—Correct Method.

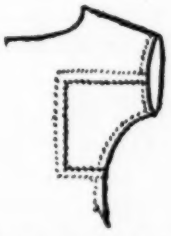


FIG. 3.—Patch Completed.

FIG. 4.—Worn Armhole

FIG. 5.—Position in New Sleeve.

FIG. 6.—New Sleeve Completed.

The garment should be pinned on the blackboard in such a position that all the class can see it.

Worn holes are surrounded by a thin part for some distance, which, if not covered, will soon break out

again. For that reason an extent beyond the hole must be cut out.

Draw the patch lines an inch beyond the hole in every direction.

These lines show where the seaming will come on the finished patch.

Let a child draw coloured chalk lines, in accordance with that rule, round the hole in the garment exposed to view. This square gives a clear idea of the size of

MENDING HOLES IN DRAWERS.—B.

FIG. 1.—Patch in Wrong Position.

FIG. 2.—Patch Correctly Placed.

FIG. 3.—Patch Sewn in.

FIG. 4.—Hole near Gathers.

FIG. 5.—Gathers Unpicked and Patch Fixed.

FIG. 6.—Patch Complete.

patch required; while the simple method of letting a child cut out in paper a piece which she *thinks* sufficiently large, will show how easy it is to cut the patch too small.

Mending material may often be obtained from other worn garments; when such is possible it will be found better than new fabric.

The right side or wrong side of the material should be found.

Let a girl measure the length and breadth of the chalked square.

Cut the size in mending material, allowing extra for fells.

Draw attention again to the chalked square.

When it runs into a band, as in Fig. 5 B, or into a seam, as in Fig. 3 B, the work must be unpicked to allow for the insertion of the patch.

Probably only three sides of the mending material will require to be fixed, as in Figs. 3 A and 5 B.

Seam and fell the patch.

Close up any seams that may require it.

Plenty of worn wearing apparel must be exhibited to the class, to get the girls so accustomed to seeing such articles that there is no danger of any nonsense, or ill-natured remarks, which would effectually hinder the sensitive girls bringing any more.

At first the teacher will probably have to demonstrate by means of her own underwear, but after a time confidence will be implanted and articles for mending will be forthcoming.

The Demonstration Lessons soon become popular, because the teacher who loves her work is so enthusiastic that she will enthuse her scholars too.

The plans above suggested apply to the preparing and fixing of patches for any kind of garment. The kind of *stitch* to be used depends upon the fabric.

It must be, however, quite clear to the child's mind what method of patching is to be adopted—whether the calico, flannel, or print method.

This is not so obvious to untrained minds as one might suppose, especially when dealing with flannelette garments, which are continually being mistaken for flannel, when the raw edges, which should have been seamed and felled, are herring-boned.

Many people think that flannelette is made of wool, whereas it is made entirely of cotton. Its fluffy woollen appearance is due to its method of preparation, which also makes it very inflammable.

Because the material is composed entirely of cotton, the "Calico Patch" method is adopted for repairing garments made of flannelette, unless it be very thick indeed, when herring-boning may be used.

For muslin pinafores, dresses, or aprons, where the repair needs to be as invisible as possible, the "Print" method is adopted.

In the case of outer woollen garments, a piece of the ordinary material laid under a hole, and the insertion of a few judicious darning stitches, will very often obviate a patch entirely.

As has been shown, sometimes strength is required, when a calico patch will be used, and sometimes, neatness being the most important requisite, the "Print" method will be adopted. Individual judgment must be exercised in deciding what is the best for the particular case in hand.

General Directions for Patching.

First step.—Find the selvedge of the article to be repaired: the length of all garments is the selvedge way. The woof will, of course, go in the opposite direction.

Second step.—Find the selvedge way of the mending material. This must be tested for that purpose.

Third step.—Draw straight lines on all sides of the hole in the garment with coloured chalk, at least one inch larger every way. This gives the size of the completed patch and also indicates where the seaming stitches will come.

Fourth step.—Measure the greatest length and greatest width of these lines, allowing a little more for turnings. Cut in paper the size required for the patch, and pin this over the hole to see that it is right.

Fifth step.—Cut this out in mending material.

Sixth step.—Unpick any seams or hems that require unpicking.

Seventh step.—Fix the patch on all four, or on as many sides as are needed.

Eighth step.—Pin it into place, and tack it firmly.

Ninth step.—Sew it on.

(*To be continued.*)

MY FRISKY PONY.

GAME.

Words and Melody by SISSIE TURLEY BUTLER. *Arranged for the Piano by* LILLIE TURLEY.

KEY G. Doh is G.

2. Do not forget the bag of food,
For my frisky pony;
Now we will give it the pony good,
Mind the purse of money.

3. Now we have come to the market town,
With my frisky pony;
Here is the shop and we all get down,
With the purse of money.

4. A bundle of hay and a bag of grain,
For my frisky pony;
Then we will gallop straight home again,
Without the purse of money.

The class form a lane, down which the horses gallop to the market town at the end. If the children stand with outstretched arms it will make the lane longer, and give a nicer gallop to the horses. About half-a-dozen horses stand with their drivers (supposed to be in traps). After second verse drivers go in front of their ponies and pretend to give them their food. The man at the shop pretends to serve the drivers, who then turn and gallop back again. These horses now form the lane, and other horses are chosen. If teacher chooses, at the end of game all may gallop as horses or drivers round the hall, trying at same time to sing a verse.

Our Modern Language Section

FRENCH PRIZE COMPETITION.

RULES.

1. All translations should be **posted not later than November 8th, 1906**, and addressed:—PRIZE EDITOR, Office of the *Practical Teacher*, 35 and 36 Paternoster Row, London, E.C.
2. Competitors should cut out and send the Coupon which appears on the Back Wrapper page of the current number.
3. Competitors should write pseudonym only on MS. Prize-winner will be asked to send name and address for publication.
4. No competitor may take the prize offered more than once in three months.

A Prize of Half a Guinea is offered for the best rendering into English of the following extract:—

Les mœurs ne furent jamais plus polies et plus décentes qu'à cette époque où la noblesse, que les leçons de malheur avaient fort amendée, et la haute bourgeoisie, qui avait conservé ses anciennes habitudes de mesure et de tempérance, donnaient le ton à la société. Il est vrai que les dissentiments politiques, au lieu d'une société, comme dans la France du xviii^e^ siècle, nous en donnèrent au moins deux; il y eut dès lors des salons royalistes et des salons libéraux. Quand la Chaussée-d'Antin ou le faubourg Saint-Honoré donnaient des fêtes, on pouvait en conclure que la faubourg Saint-Germain avait des raisons de bouder et de s'abstenir. Royalistes ou libéraux avaient de commun le goût d'une élégance sans faste, l'amour de la vie de salon, la recherche de la société des femmes. La vieille conversation française, avec sa galanterie respectueuse et spirituelle, vivait encore. Les habitudes contractées dans les cercles (ceux-ci ne se multiplièrent guère qu'à partir de 1840) ne l'avaient pas encore tuée. On retrouvait, dans les salons de 1820 et de 1840, les mots ingénieux, jusqu'aux madrigaux de l'ancien régime. On y parlait aussi de politique, philosophie, art, littérature, mais on parlait peu des sciences, comme on le faisait avant la Révolution, car la période parlementaire est avant tout littéraire. L'influence des classes dirigeantes dans la vie de société n'était pas encore menacée par celle des classes populaires: il était rare qu'on se permît, dans les conversations, de citer un mot d'argot. Elle n'était menacée que par les *enfants perdus* de ces classes, les artistes et surtout les rapins, les littérateurs et surtout la *bohème littéraire*, pour qui les idées, les modes, les goûts artistiques ou littéraires des classes censitaires étaient autant de motifs à leurs mots et à caricatures, et pour qui le mot de *bourgeois* était synonyme de tout ce qu'on peut imaginer de plus arriéré.

From "Histoire de la Civilisation Contemporaine en France," by ALFRED RAMBAUD.

RESULT OF THE OCTOBER COMPETITION.

The prize is awarded to "Poulard aîné." (Will "Poulard aîné" kindly forward name and address for publication?)

First Class.—D'Arcy, Eicarg, M. H. P., Keeldees, T. V. D., Bruno, Senga, Chorister, Phil, Devanka, L. B. G., Winnowsty, Caudebec, Awa Maru, Agaznog, Y. Y., Ariston, Eve, Liverpool, M. L. N., W. M. E., Amrit, Ceccles, Ten, Entente cordiale, Bruce, Rita, M. A. H., W. E., F. G. D., Marcus, Tyro, Sinjun, Gladiator, Bobby, Honi, Zelda, Jan, ——, Cardno, Badulla, Carpe diem, Phèdre, H. H., W. E., Ray, Winoma, Malvina, Comet.

Second Class.—Bee, Montrose, Elida, Viola, F. J. L., Cissy, Amphilfleura, Patsy, Winton, Nil Desperandum, Max, Orcadiensis, M. S.

The name and address of "J. M. F.," the winner of last month's competition, are: Mr. J. M. Forsyth, 1 Eastfield Terrace, Dumbarton, N.B.

Report.

Many good papers have been sent in, and only a few very poor ones. *La bourgeoisie* was one of the common occasions of failures. "The citizens" and "the citizen's wife" were the mistranslations most in favour. It means, of course, "the middle classes," as distinguished from *les classes ouvrières* and *l'aristocratie*. *Bêtes à concours* also entrapped not a few students, who did not know that *bête* is so often used in French with an idea of humorous contempt attaching to it, and not in its original sense of "beast."

Prize Translation.

The middle classes are ready enough to shirk parental responsibilities and social duties. They banish the child from the home, they forget it at college or in the convent.

First they step aside for the nurse, then for the university-man, a nurse in a frock coat, or with a degree. They have found that money can relieve them of every duty. Then why not of the duty of educating their children? And, if reliance on their wealth demoralises the parents of paying students, reliance on State-aid also demoralises the parents of scholarship students. The latter commonly imagine that the State has freed them from all responsibility, and is in duty bound to see not only to the maintenance of its exhibitioners, but also to their success in their examinations, their future prosperity in life, etc. So, if university authorities, in order to awaken their slumbering sense of responsibility, give fewer full scholarships, and compel parents, when they can, to supplement them themselves, we ought to congratulate ourselves on such an excellent means of combating universal indifference. However, every parent does not look on the College as a "depository for encumbrances"—they are not all like a certain field officer who for a whole year regularly every evening took a hand at piquet at his café with a congenial partner, and only then found out that he was his son's tutor . . . by seeing him on the platform at the prize distribution. There are also some who co-operate too much. Such are those who encourage their sons in a jealous emulation or in unreasonable overstudy, the parents of "examination fiends" or of "youthful prodigies."

POULARD AÎNÉ.

L'assiduité.—Si l'on veut savoir quelque chose, il faut travailler *avec suite, avec persévérance*, à l'âge où la mémoire retient facilement ce qu'on lui confie. Une journée perdue ne représente pas seulement une perte de temps matérielle. La valeur même du travail de l'écolier s'en ressent. Il est plus difficile de reprendre sa tâche après l'avoir interrompue. Il faut un nouvel effort pour *se remettre en train*.

OUR TUTORIAL SECTION

NEW SCHOLARSHIP COURSE FOR 1906-7.

BY ARTHUR T. FLUX,

Late Principal of the Belvedere Pupil Teacher Centre, First on Scholarship List; Author of "Scholarship School Management," "Building of the British Empire," etc.

Work for the Month.

PART I.

1. *Reading.*—The advice must be reiterated which has been given each month; steady and regular oral practice before a competent critic is absolutely essential. The object aimed at is not mere verbal accuracy, but an intelligent and interesting interpretation of the author's meaning, shown by proper expression and modulation of the voice. The merely mechanical part of the exercise—the vocal sounds of the printed words—affords many pitfalls for the beginner. The clear and distinct enunciation of the consonants, especially the finals, demands continual attention, and has been dealt with in earlier notes. There is also the accent, which must be learnt by practice, as there are no rules to guide the reader. The proper pronunciation of foreign or classical names is also the mark of the cultured reader. To pronounce Penelope as "Penny-lope," or Eurydice as "Eury-dice," would raise a smile on the face of the examiner, although in all probability it would not be exactly novel to him. If any doubt is experienced, consult a dictionary for the accent. How do you accent the syllables of admirable, deficit, aerate, formidable, adult, vehement, abdomen, acumen, plebeian, mischievous, herculean, etc.?

2. *Recitation.*—The remarks above apply equally to this exercise, which must be perfect.

3. *Penmanship.*—Write a page daily in a good copybook, and use great care at all times. Like reading, this is a subject of which every candidate feels sure, when, in the majority of cases, it is extremely weak. There must be definite rules for the lengths of loops, the up and down strokes must be evenly spaced, and there should be an ease and grace about the copy which evinces that the writing is done easily and naturally.

4. *Composition.*—It is interesting to one who works such a course as this, to notice with what persistency the same question arises over and over again. During the last two days, the never-ending query has been forthcoming, "How can I improve my composition?" This question I have been trying to answer each month, and if correspondents will read through what has been said in the paper since the present course began, they will find many hints and much advice on the point. A good essay depends on two things: (1) Good ideas on a subject, and (2) the expression of these ideas in forcible and correct English. The first point can only be attained by reading wisely and widely, and the second by continual practice and correction. There is (once again) no royal road, no short cut to excellence, learning rules is largely useless, and studying manuals on composition a waste of time. You must practise; perfection will slowly, but surely, come nearer. Having, by reading or otherwise, obtained a sufficient store of ideas, arrange them under proper heads in logical order, and then express your meaning in the best English at your command. Do not strive after effect; a good essay can be written without the use of five-syllabled words or classical quotations. Some excellent advice is given in Abbott and Seeley, which you will do well to lay to heart.

Continue the exercises on correction of sentences. The following is the correction of the sentences set last month:—

(1) "Verbally" should be "orally." "Verbally" means by words whether written or spoken. "Orally" refers to words spoken only.

(2) The whole sentence is bombastic.—"Sartorial art" = tailoring, "culinary art" = cooking. Say, Tailoring is as difficult as cooking.

(3) The meaning is not clear. "Antony was not less desirous of destroying the conspirators than his officers," may mean that he wished to destroy his officers. Place the words "than his officers" after "desirous."

(4) Ambiguous. The ship was not insured "with cement."

(5) "On that subject he was literally at sea." "Literally" is used in the wrong sense, it means "true to the letter;" "metaphorically" would be better.

(6) A "number" of books, not a "quantity."

(7) Simpler—"The drug alleviates but does not prevent fever."

(8) Ambiguous. Does "regularly" apply to "take" or "send"? Whichever is intended, the adverb should be in close connection with the word modified.

Correct the following, and give reasons for the correction:—

(1) We have been disturbed ever since the child was born three or four times a night.

(2) He had expended a considerable sum in erecting a residence.

(3) The lady is vain of her carriage.

(4) Their ideas are in some respects identical with the vegetarians.

(5) The colonists shot down the natives for killing the sheep as if they were birds.

(6) A strange man had struck her and then ran away.

(7) Wanted, a boy to open oysters with a reference.

(8) It is strange that he should as he had by the pleadings deny the promise.

Distinguish between the meanings of the following pairs of words, and use each appropriately in a sentence;—

deprecate—depreciate
perspicuity—perspicacity
ingenious—ingenuous
corporal—corporeal
observance—observation
eminent—imminent
complement—compliment.

Write one or two essays each week on such subjects as—

(1) Instinct in animals.
(2) Self-reliance.
(3) The advantage of recitation from memory.
(4) On books and how to choose them.
(5) Benefits of exercise.
(6) Characteristics of the cat tribe.
(7) Advantages and disadvantages of a free press.
(8) Is war justifiable?

The following notes may be of assistance:—

(1) Define the term. "Instinct" is applied to the innate motive force which prompts animals to perform certain actions which do not depend upon reason. Man is a reasoning animal, that is to say, nearly everything he does is done with a purpose. He goes through a chain of argument, and convinces himself that he is doing what is the best thing to gain the ends which he seeks. But animals seem to work under certain laws over which they have no control, *e.g.* a beaver in captivity will construct a dam in one corner of the room where it is perfectly useless and unnecessary. The divine Creator seems to have implanted this tendency in animals instead of supplying them with more powerful reason. It is extremely difficult to distinguish between the pure instinct in animals and the reason acquired from experience. Probably instinct plays a much smaller part in the working of an animal's mind than one is accustomed to believe. Much of what is termed "instinct" is undoubtedly mother teaching, *e.g.* the dread of man is not innate, but acquired. The books of Mr. W. J. Long, the American naturalist, abundantly prove this.

(2) If possible read Emerson's essay on this subject. One of the greatest factors in success is a belief in one's own powers, or, stated otherwise, diffidence is fatal to ultimate success. It is undoubtedly true that too much of our lives is occupied with considerations of what the world will think of us; we slavishly follow what we believe to be wrong rather than face the annoyances which would arise from an outspoken statement of our ideas. The whole trend of modern society is to eradicate the individualism and reduce all to one common pattern. Fashion,

as it is termed, compels us to wear what we do not like, and to do what we know is not the best for us. The men who have done great things have been those who possessed sufficient self-reliance to carry out their own ideas in the face of all opposition. Columbus would never have discovered America and he listened to other people's opinions. Great explorers have made great reputations because they have done what the world had settled was well nigh, if not quite, impossible. Disraeli would never have been Prime Minister had he accepted the verdict of the House of Commons on his first appearance, and so on. Examples can be multiplied indefinitely. Of course there is a great difference between self-reliance and foolhardiness. The self-reliant man examines a question for himself, weighs up the pros and cons, and, having made his decision, stands by it. It is not the recklessness which arises from ignorance that one admires; it is the determination at all costs to proceed on the path which careful judgment has indicated.

(3) "Lost, stolen, or strayed," says Lamb, "the good old custom of learning by heart." In bygone days, when books were scarce and costly, learning by heart was a common custom. Now that everything can be found in books we are more content to know *where* we can find a fact, than to learn the fact. Memory is strengthened by exercise. The concentration of effort necessary to commit a passage to memory is a good habit in itself apart from the advantage of a well-stored mind. The Homeric poems were handed down for generations by word of mouth. The doctrines of the Druids took years to learn, but now we are content in our schools to let children off with their minimum of forty to a hundred lines, when they could easily learn a thousand. What is learned must be good. If we take the best ideas of good writers expressed in the best languages, and make them our own, we acquire a store of learning, of expression, of ideas which must influence powerfully the whole of our life. Their ideas become part of us—a part which is fixed, and cannot be removed.

(4) "Of making books there is no end, and much study is a weariness of the flesh" was the verdict of the Preacher centuries before the era of the daily paper and the Walter machine. He seems to have felt dimly that there was so much to be learned and so little time to do it in, and surely that is the feeling of every reader nowadays. The result is most unfortunate; it has made us a race of nibblers, tasting here and there, flying from one topic to another, from one book to another, and never striving to master thoroughly what is worth effort. The modern magazine is pleasant, it is interesting, every device is employed to serve up its contents in the most attractive manner, but literature of this sort is as whipped cream to strong meat. It was Ruskin, I think, who refused to draw up a list of the best hundred books, because no man in one lifetime could ever read them. There is a substratum of truth in this. A good book needs to be "chewed and digested," and if it is not worth that, it is hardly worth tasting. Of the thousands of books published annually a few will attain everlasting fame; the others are ephemeral. Emerson's rule is a good one: Never to buy a book till it has had a circulation of two years, and is at the end of that time increasing in reputation.

(5) Exercise is a law of nature, an essential of growth. No part of the threefold man—body, mind, or soul—can develop without it. The continual movement of young animals, the "fidgeting" of infants, is an instinct not to be crushed and eradicated, but to be properly directed. The benefit of exercise is more apparent in the physical body than on the mind, because it can be measured and weighed, but the development of any one part to the exclusion of the others is warping the whole being; muscle without brains, or brains without muscle, or either without high ethical aims, is not perfection. There is a wave of anxiety as to physical culture passing over the country. There should be equal anxiety as to mental and spiritual culture. Like every other good thing, the worship of physical strength may easily be carried to excess, and the results are harmful. The object to be aimed at is the old Latin adage, ***Mens sana in corpore sano***—a healthy mind in a healthy body.

(6) Little assistance should be needed with this. The student should notice the wonderful adaptation of structure to mode of life. Having to take prey by surprise, and not by chasing, as with the dog tribe, all the animals of the cat family are lithe, silent in their movements, cleanly in their persons, and persistent in watching and waiting.

(7) The free and unrestrained expression of opinion possesses great advantages. It has built up with us a powerful institution. "Public opinion" possesses greater powers than Parliament itself. Criminals and felons, who have made themselves liable to the punishment of the law, and not less others who, though not law-breakers, are nevertheless wrong-doers, are judged and sentenced. The publicity given in the press is a powerful deterrent from evil. Many men and women curb their evil passions and desires because of what the papers would say if they indulged them. The press of to-day (in England) is as a rule pure and fearless. Vices and shams are attacked and exposed, merit is recognised and acclaimed. In some cases the general tone of a paper may be bad in the eyes of the majority, but it is better to allow free expression than to attempt to suppress it.

There are some disadvantages. Editors and journalists are but human, and make mistakes. Detailed information is sometimes given which might well be suppressed. No healthy-minded man wants to read the details of some loathsome crime, or the immorality revealed by the divorce courts. It is only prurient and diseased minds which can revel in such filth. Occasionally the press may, by erroneous information, entirely mislead the nation, but this is rare.

(8) This is a difficult question, and must be carefully reasoned. When a war is undertaken for mere conquest, to gratify some fancied wrong, to give vent to hatred and jealousy, it is hard to find any justification. But when a nation rises in arms to repel some invader, to put a stop to some cruelty, to advance the welfare of the world, it is difficult to blame.

5. *Arithmetic.*—Interest and Discount. Study the theory as given in Christian and Collar, and work as many examples as possible, sending up for solution any problems which present difficulty.

Work also the following:—

(1) If by selling wine at 15s. a gallon I lose 10 per cent., at what price must I sell it to gain 15 per cent.? *Ans.* 19s. 2d.

(2) If a man rows 10 miles in $2\frac{1}{2}$ hours against a stream which runs at 3 miles per hour, how long would he be rowing 5 miles with it? *Ans.* 30 mins.

(3) Three men start together from the same point and walk continually in the same direction, round a circle $\frac{1}{4}$ mile in circumference, in 10, 18, and 90 mins. respectively. Find the least time in which they will be together, and the number of miles each travels. *Ans.* 2970 yds., 1650 yds., 330 yds.; $22\frac{1}{2}$ mins.

(4) A rectangular grass plot, the lengths of whose sides are in ratio of 5 : 6, cost £16, 11s. 6$\frac{1}{2}$d. for turfing at 5d. a sq. yd. Find the length of the sides. *Ans.* 25·75 and 30·9 yds. (*N.B.*—$\frac{1}{6}$ of the total area is a square.)

(5) What angle do the hands of a watch make at 27 mins. past 2? *Ans.* 88$\frac{1}{2}$°.

(6) At a certain game of skill A can give B 10 points out of 50, and B can give C 10 points out of 50. How many points can A afford to give C out of 50? *Ans.* 18.

(7) If a snail on the average creeps 2 ft. 7 in. up a pole during 12 hrs. in the night, and slips down 16 ins. during the 12 hrs. in the day, how many hours will he be getting to the top of a pole 35 ft. high? *Ans.* 636 (nearly).

(8) If 8 men or 21 boys can finish some work in 13 days, how long will 12 men and 14 boys take to do it? *Ans.* 6 days.

(9) If 317 be the G.C.M. of three numbers, and the other factors of each are 57, 209, and 231, what is the L.C.M. of the three numbers? *Ans.* 1391313.

6. *Drawing.*—One or two freehand copies each week, and one or more groups of models. In the freehand the student must find out at first the general lines of construction, and draw them in proper proportion. The filling in of details is then comparatively easy. Good balance, smooth soft flowing lines, are the chief objects to be aimed at.

7. *Music.*—Continue the regular practice in the Practical Exercises.

For this month finish the Tonic Sol-fa: Transposition, Bar Times and Signatures, Syncopation, etc. The only point of difficulty will be transposition of key and the use of bridge notes. Any text-book will, however, explain this, and a little practice will make quite clear. Work the following exercises, and send up for correction if you cannot get them revised at home:—

(1) Fill up four 3-pulse measures, introducing syncopation at least once in each measure.

(2) What is the average compass of the treble voices of women, children under ten, and children over ten?

(3) In what key should the following passage be set (*a*) for average young trebles and (*b*) for average young altos:—

d s_1 l_1 s_1 f_1 m_1 s_1 l_1 m r t_1 d

(4) Rewrite the following passage, making a change to the first sharp key at (*a*) and a return to the original key at (*b*):—

(*a*) (*b*)

s d r t_1 m fe l s fe t d^1 fe s r f t_1 d

(5) If the first note of each of the following passages is regarded as *ray*, what will the others become:—

(*a*) l fe s d' m r fe l t d' fe l s

(*b*) s f ta l m f d' ta r' f ta l

(6) Which one of the following notes is highest in pitch, and which one lowest? Give the absolute pitch in each case:—

(*a*) f in key A. (*b*) l in key G. (*c*) s in key B♭.

(*d*) t in key C. (*e*) l, in key A♭. (*f*) d in key D.

(In answering a question of this kind, construct a modulator and work out the exact position of each note.)

(7) Rewrite the following passage in 9-pulse measure, preserving the accent and relative duration:—

{| m :s ,f ,m :f | m :— :r ,.d | r : :m | m :- ,f ,r :d ‖

PART II.

1. *English Grammar and Literature.*—Work for the month:—
   (*a*) The figures of speech.
   (*b*) Abbott and Seeley—Part II., Chapter IV., Simile and Metaphor.
   (*c*) Read Shakespeare's *Twelfth Night.*
   (*d*) Next twenty poems in the *Golden Treasury* or any good collection of poems.
   (*e*) Read *Kenilworth*, *Westward Ho*, Scott's *Monastery* and *Abbot.*

Notes.—(*a*) The student should be able to recognise readily the various figures of speech employed in English. They are used to embellish the language, to make statements clearer or more forcible, or to produce some desired effect in the reader's mind. The chief of them are as follows:—

(1) *Simile* is a statement of resemblance expressed fully between two things not alike in other respects, *e.g.* As a plough cuts through the land and leaves a furrow behind, so a ship cuts through the sea.

(2) *Metaphor.*—A metaphor is a contracted or implied simile, *e.g.* The ship ploughs the sea; The anchor of faith. A metaphor can always be expanded into a simile, *e.g.* As an anchor holds a ship fast in the midst of currents and waves, so a man's faith holds him firm in the midst of discussions and arguments.

(3) *Allegory.*—An allegory is a tale wherein the incidents are intended to illustrate and explain incidents of a totally different kind. Thus the *Pilgrim's Progress*, under the guise of telling of a man's journey, really describes his passage through life.

(4) *Parable.*—A parable is a short allegory. Those in the New Testament and their explanations are excellent examples.

(5) *Fable.* A fable is a tale employed to teach some truth wherein animals are represented as talking, etc., like men.

(6) *Antithesis*, as the name implies, is the bringing of words and sentences into striking juxtaposition—*e.g.* Abroad he was an angel, at home a beast.

(7) *Epigram* is defined by Bain as "an apparent contradiction in language which, by causing a temporary shock, rouses our attention by some important meaning underneath." Thus, In the midst of life we are in death; We live by dying.

(8) *Metonymy.* In metonymy a thing is not named but is indicated by some accompanying circumstance—*e.g.* The crown (for the position of king), the colours (for the army), grey hairs (for old age), the kettle boils (*i.e.* the water in the kettle), He is fond of a glass.

(9) *Synecdoche* (which must not be confused with Metonymy) is the indication of a thing by something cognate which is *not* an accompaniment—*e.g.* He takes too much liquor (*i.e.* intoxicating drink), They went into action (that is, battle).

(10) *Irony.* When a writer or speaker means the opposite to what he says, knowing that his words will not be taken in their literal sense—*e.g.* You are wonderfully clever! (meaning you are not at all clever).

(11) *Personification.* When inanimate things are considered as having life and thought—*e.g.* Freedom shrieked; The bridge groaned and grumbled under its burden.

(12) *Apostrophe.* A "turning away" from the main line of thought, to address some object animate or inanimate—*e.g.* Bryon's apostrophe, "Roll on, thou deep and dark blue ocean."

(13) *Hyperbole* is an over-statement for the sake of emphasis—*e.g.* They were countless as the sands of the seashore, Myriads of rivulets hurrying over the lawn, An immense room (*immense* means *unmeasurable*).

(14) *Litotes* is a statement made by negation; *e.g.* He is no fool, He took no small part in the arrangement of affairs.

(15) *Euphemism* (do not confound with Euphuism) is calling a thing by a pleasant name when in itself it is not pleasant—a softening down—*e.g.* He fell asleep (for he died), He wandered from the paths of strict veracity (=He lied).

Take any poem, and go through it carefully, noting the figures of speech employed.

(*b*) This chapter in Abbott and Seeley is not only interesting but very useful as an aid to composition. It must be studied carefully, and its teaching put into practice.

(*c*) *Twelfth Night* is one of the prettiest and most amusing of Shakespeare's plays, and will amply repay careful perusal. The plot is ingenious. The Duke is in love with Olivia, and employs Viola (disguised as a boy) as his messenger. Olivia falls in love with Viola, Viola with the Duke, but Malvolio the steward is made to believe that his mistress is in love with him. Sir Toby and Sir Andrew Aguecheek are a pair of merry rascals, aided in their tricks by the clown and the wit of Maria. The appearance on the scene of Sebastian, the twin brother of Olivia, complicates matters for a period, but affords a natural solution to the imbroglio. The Duke discovers that his love for Olivia is more or less an imagination, and Olivia is quite willing to substitute the brother for the sister.

There is not a dull line in the play, the characters are real living persons, and enlist our sympathy at once. Sir Toby is of the same type as Falstaff, but yet a different individual. Sir Andrew is far more amusing than he would acknowledge himself to be; his humble affection for Olivia, the manner in which he allows Sir Toby and Maria, "as witty a piece of Eve's flesh as there is in Illyria," to mould his fortunes, to drain his purse, and to puff up his conceit is all extremely humorous. Malvolio, the badly used, is not altogether a self-conceited ass. There must have been something in him which warranted the position he held as steward to a rich lady, and, although he fell headlong into the trap laid for him, he emerges with something like dignity. The wit and humour throughout the play is infinitely superior to the rubbish which often passes nowadays as comedy.

(*e*) There are so many novels dealing with the Elizabethan age that it is difficult to select the best, or to limit the number to two or three. It has always been an attractive age to the writer—the "spacious times of great Elizabeth" abound in incident and possibilities. Kingsley perhaps gives the best picture of English life of the period in *Westward Ho!*—the newly found love of adventure, the hatred of Spain, the simple and honest faith and religion, the final struggle with the Armada, are painted in vivid colours. An age which produces such a man as Sir Richard Grenville—a gentleman, a courtier, a wise general, a fearless admiral, and a true Christian—is well worth careful study.

Kenilworth takes us rather into the Court life of the Virgin Queen, the scheming and plotting for her favour, her "progresses" through the country, and the conduct which earned for her the title of "Good Queen Bess."

In *The Monastery* and *The Abbot* Scott gives us an excellent picture of the civil war in Scotland.

If it is not possible to read all four books, read at least the first two.

2. *History.*—Edward VI., Mary, and Elizabeth.
Chief points—

Edward VI.	The progress of the Reformation.
	The Protectorate of Somerset and the causes of his fall.
	The rise to power of Northumberland.
Mary.	Lady Jane Grey.
	Loyalists Rebellion.
	Reconciliation with Rome.
	The Marian persecution.
Elizabeth.	The difficulties of her early years.
	The relations with France and Scotland.
	The development of England.
	The plots against the Queen.
	Foreign affairs in the Netherlands, Spain, and France.
	The execution of Mary, and the Spanish Armada.
	Affairs in Ireland.
	The great men of the reign—soldiers, sailors, writers.
	Legislation during the reign.

Notes.—Social condition of the poor.

Previous to the dissolution of the monasteries, there had been no urgent question as to what to do with the poor. The monks had established themselves as general relieving officers; it was possible for any one to live in indolence by wandering from one

monastery to another, and the common lands afforded pasturage to the cattle of the poor. With the dissolution of the monasteries this was all changed. The church lands passed into the hands of greedy courtiers who were anxious to wring the last penny from the tenants, many estates were turned into sheep farms, displacing the agricultural labourer, the common lands were seized, and thus there were many unemployed just at the time when all means of assistance were taken away. Believing that the distress was the result of the Reformation, the people broke out into revolt—*e.g.* the Pilgrimage of Grace, Ket's rebellion, etc., and after they were suppressed, bands of hungry men wandered about in search of work to the annoyance and danger of the community. The question of the poor became acute, and the steps taken to alleviate the misery were not well considered.

In 1548 a Vagrant Act was passed. Vagrants were to be branded, and in case of attempted escape to become slaves. But destitution cannot be suppressed by such Acts of Parliament. Some years previous, in 1535, collections were ordered in churches for the poor who were not able to work, but this system of voluntary relief was bound to fail in spite of the law, made in 1562, that those who refused to subscribe were to be punished. In 1572 Houses of Correction were established for obstinate vagabonds, and all inhabitants were assessed by the Mayors or Justices.

It was not, however, till the great Poor-Law of 1601 that the difficulty was effectually solved. The collection of the poor-rate was transferred from the justices to overseers appointed by the parish. Each parish was made responsible for its own poor, and the system of outdoor and indoor relief initiated. This worked so well that little change was made for over two centuries.

The difficulties at the commencement of Elizabeth's reign—

It is remarkable that under three queens, Elizabeth, Anne, and Victoria, England has made remarkable progress. To understand the events in the reign of Elizabeth, it is necessary to appreciate exactly the difficulties which confronted her, and the steps taken to remove them. In 1558 there was no army, no navy, an impoverished treasury, a debased coinage, little trade and commerce, active enmity and hostility of France and Spain and Scotland, and a bitter religious controversy raging at home. In less than fifty years this was all changed, there was no standing army but a yeomanry trained to the use of arms, a powerful navy which had lowered the pride of Spain, the treasury was richer, the coinage had been restored, trade and commerce had increased largely. France was friendly, Spain was crushed, Scotland was a pensioner, and above all Catholics and Protestants were living together in friendly toleration. Now all this was not secured without much careful thought and planning, much labour with the pen and the sword, many anxieties and dangers; and it is in tracing these moves and countermoves that the chief interest of the reign lies. To take a few instances: In the early years both France and Spain were deluded into thinking that Elizabeth would marry a French or Spanish prince—a project far from her plans. When they came to the conclusion that they had been fooled, England had already begun her upward movement, but was not strong enough to repel an invasion had one taken place. But France was kept busy by the help given to the Huguenots, and Spain was tied by the revolt of the Netherlands, awed by England, and by the blows struck at her shipping wherever English and Spanish met. When finally Philip made up his mind to invade England, it was too late. Again Elizabeth rewarded men who *did* something; they were in many cases unlicensed pirates, but they brought wealth to England. The thirty-two waggons which conveyed Drake's plunder to London were filled with what had been stolen, but the criminal was knighted. When the persecution in the Netherlands drove the Flemish weavers to England, they were welcomed, comfortably housed, and established at their trades; so that, whereas England had always been in the habit of buying cloth, she now began to manufacture it. And so throughout the reign events were guided by wisdom and prudence.

Was Elizabeth justified in detaining and ultimately executing Mary Queen of Scots?

When Mary took refuge in England, four courses were open to Elizabeth:—

(*a*) To hand her over unconditionally to the Regent Murray.
(*b*) To restore her to her throne under English protection.
(*c*) To permit her to pass on to France.
(*d*) To detain her in England.

(*a*) Was Cecil's advice, but Elizabeth objected. She held all the Tudor ideas of sovereignty, and objected on principle to a queen and cousin being at the mercy of her people.

(*b*) To do this was to condone the faults—not to use a more serious name—which Mary had committed, and would have been a most unpopular course in England and in Scotland.

(*c*) If Mary had gone to France she would have been the centre of plots against Scotland and England.

(*d*) Was the course least justified into which Elizabeth drifted.

It is very difficult to justify the execution of the queen—it was expedient, but it was not right. As a sovereign of another country she could not be amenable to English law. She was not an English subject, and therefore could not commit "treason." Her execution was a challenge to the Catholic world. England had never felt safe while she was in captivity. Her attractive personality had caused many plots against the peace of the realm, partly political, partly religious. Her case presented one of those difficulties which statesmen cannot solve in an ordinary manner by diplomacy, and the bold step taken was justified by after events.

The religious difficulty was to a great extent removed. Severe laws against Roman Catholics were passed, but they were not put into execution except in cases where people forced themselves upon public notice. There was a sufficient toleration to make Catholics Englishmen first and Churchmen afterwards, so that when the Armada came, Catholics no less than Protestants rose in vigorous defence of their liberties.

The most striking feature of Elizabeth's reign is the birth of a great national spirit of freedom. It was as though a hideous incubus had been shaken off, and men for the first time felt themselves free. The wonderful outburst of poetry and drama is unparalleled. The night had passed away, and England became a "nest of singing birds." The new freedom was intoxicating, and forms the explanation of the exploits of the sea-dogs. Improved methods in agriculture were introduced, requiring more labourers, and partly solving the agrarian difficulty, manufactures commenced, new trade-routes were opened to America, India, Russia, etc., a new style of architecture was introduced, in which comfort rather than strength was the object aimed at, and the stately Elizabethan mansions which still remain are evidence of this. There was a general demand for greater domestic comfort. Whereas previously the stone walls had been bare, the furniture rough, the beds mere bundles of straw, now the walls were hung with tapestry or wainscoted with oak. Rich people used Venetian glass, Turkey rugs lay on the floor, beds were hung with silk or tapestry, and fine linen decked the table. There was a greater variety of food with the increase of commerce, and a greater variety in costume.

Citizenship.—Chapters xii.-xiv. Peaker's *British Citizenship.*
The Board of Education—The Board of Trade—The Post Office.

Special Period.—Victoria, 1845 to 1854.

The early years of Queen Victoria's reign present in some respects a parallel to the early years of Elizabeth. There was acute distress and much discontent, and, as in the case of the Tudor queen, the end of the reign was a tremendous contrast to its beginning. The increase in wealth between 1837 and 1900 was enormous. The national revenue in 1837 was about 40 millions, in sixty years it increased to 130 millions.

The first great social question was the food of the people. England was fast becoming a manufacturing country; the great towns of the north had to depend for their food supply on other parts of England, or other countries. In 1815, in order to bolster up the price of corn and give prosperity to the farmers, the Corn Law had been passed, prohibiting the import of foreign corn till British wheat reached the prohibitive price of eighty shillings a quarter. The result was obvious; farmers and landowners did well at the expense of the artisans, who barely had enough to eat. In 1838 the Anti-Corn Law League was formed by Cobden and Bright, who rightly argued that food supplies—if necessaries of life—should be the last thing taxed. They received the support of the labouring classes, and were opposed by the farmers and landowners. The failure of the potato crop in 1845 and the Irish famine of 1846 brought things to a crisis, and the obnoxious laws were repealed.

Another great movement which must be carefully studied was that of Chartism. The Reform Bill of 1832 gave greater political power to the people, but it did not go far enough. The Chartists thought that with further reform an era of peace and prosperity must ensue. The charter which was drawn up demanded six things:—

(1) Universal Suffrage—every man over twenty-one to have a vote.
(2) Annual Parliaments.
(3) Vote by Ballot—*i.e.* each man should vote secretly and not

openly, thereby preventing the undue pressure always placed on poor voters.

(4) Payment of Members.

(5) Abolition of Property Qualification.

(6) Equal Electoral Districts.

These demands were thought at the time to be revolutionary and dangerous, but they were not so, as subsequent events have proved.

Universal suffrage has practically been granted. Annual parliaments are not advisable, since one year of office does not allow any government time to initiate and carry out a policy. Vote by ballot was secured by the Ballot Act. Members are not paid yet, because it is unnecessary so long as good men will work for nothing. It is no longer a condition of election that a member shall hold property to the value of £500 a year, and the country is divided roughly into equal electoral districts. Thus four-sixths of the demands have become law.

Note the Revolutionary Year of 1848, the Afghan and Sikh wars, and the Great Exhibition.

3. *Geography.*—Work for the month.

(1) Physical.—The oceans in detail, tides and currents.

(2) Holland and Belgium.

(3) Revise Mexico and Central America.

Notes.—(1) Tides are produced by the attraction of the sun and moon, their relative powers being as 2 to 5. The great mass of the sun operates on the whole surface of the sea, the moon being smaller acts locally, and hence has the greater power. The theory of tides must be carefully studied. It is important also to notice that only in one ocean—the Pacific—is there a sufficient expanse of water to allow of a tidal wave being formed. This wave travels east to west across the Pacific and Indian Ocean, then south to north in the Atlantic. The various positions of islands modify its course so that it sometimes travels west to east and north to south on narrow seas. The tide in London is the wave produced by the moon *two whole days before* in the Southern Pacific.

The cause of the currents is important and also their names and direction. A map must be drawn (Mercator's Projection), and the course of each current indicated.

(2) In studying the separate countries every effort must be made to get at the real social and commercial condition of the people. The industries, productions, imports, and exports are more important, the towns and government must be clearly understood. The continual use of sketch maps is an essential to a thorough knowledge.

Mexico is a Federal Republic consisting of twenty-seven states, two territories, and the federal district of Mexico, with an area of over three-quarters of a million square miles and a population of fourteen millions.

The chief productions are maize, wheat, barley, pulse, sugar, coffee, cotton, tobacco, vanilla, and all kinds of tropical fruits. Mahogany, rosewood, ebony, and caoutchouc trees abound in the forests, and there are valuable deposits of silver, gold, copper, lead, quicksilver, iron, and coal. Manufactures are few, most of the textiles being imported.

The States of Central America are all republics sparsely populated and of little political importance. The project of a canal across the Isthmus of Panama is abandoned, but probably one will be constructed across Nicaragua *via* the San Juan River and Lake Nicaragua.

Test your reading by *Test Questions in Geography* (Meiklejohn and Holden).

4. *Elementary Science.*—Those students who cannot avail themselves of laboratory practice in chemistry would do well to take Section B as the second part of their science. The apparatus needed can be bought or constructed at a trifling cost.

For this month read—

Mechanics—Weight. Centre of Gravity. Parallelogram of Forces, Levers, Velocity, Energy and Work. Storing of Energy. Work as many of the experiments given in the text-book as possible, and write for assistance in any difficulty. The Parallelogram of Forces is very important, and the three orders of levers are used continually in machinery and everyday life.

5. *Elementary Mathematics.*

(*a*) *Arithmetic.*—Profit and Loss. Interest and Simple Discount. If you have clearly understood Percentages, there will be little difficulty in this section of the work. Read the explanations in the text-book (Christian and Collar); nearly every type of sum is clearly explained. Work as many of the examples as possible, and write for assistance in any difficulty.

(*b*) *Algebra.*—L.C.M. by factors. Work the examples in Hall and Knight.

(*c*) *Geometry.*—Construction of circumscribed, inscribed, and escribed circles of a triangle.

(*d*) *Euclid.*—Propositions 32–41, Book I., with four deductions per week.

(After this month a complete paper will be given each month in Mathematics.)

Test Questions.

(The answers to these can be marked at a nominal charge by arrangement.)

1. Write as specimens of copy setting:—

(*a*) Large hand.—Experimentally.

(*b*) "Every Man in His Humour," was written by Ben Jonson.

2. Work the following:—

(*a*) A train starts with its full complement of passengers. At the first station it drops $\frac{1}{6}$ of them and takes in 96 more. At the next it drops $\frac{1}{3}$ of the new total and takes in 12 more. On reaching the third station there are 248 left. What number started?

Ans. 564.

(*b*) A cistern has two pipes, by one of which it can be filled in 20 minutes and by the other in 25 minutes. It has also two discharging pipes which empty it in 18 and 40 minutes respectively. If the cistern be half full and all the pipes be opened, in what time will it be quite full? Ans. $52\frac{1}{2}\frac{2}{9}$ mins.

(*c*) A man had two sons. To the elder he left $\frac{2}{3}\frac{5}{7}$ of his estate, and $\frac{2}{3}\frac{5}{7}$ of the remainder to the younger, the rest going to the widow. If each son received the smallest multiple of £10, what sum did the widow receive. Ans. £553$\frac{1}{7}$.

(*d*) A and B can do a piece of work in 6 days, B and C can do two similar pieces in 11 days, and A and C can do three similar pieces in 19 days. How long would B take alone?

Ans. $110\frac{1}{1}\frac{1}{3}\frac{3}{3}$ days.

(*e*) Divide a unit into 5 parts, of which the largest is as large as the other four together, the next largest as large as the three smaller ones together, these latter being equal. Then take three of these parts. Do you get $\frac{1}{2}$? If not, what do you get?

Ans. No; $\frac{3}{5}$ or $\frac{3}{8}$ or $\frac{3}{1}\frac{3}{9}$ or $\frac{1}{4}$.

3. Write and explain the various forms of the minor scale.

4. What is Tautology? How does it arise and what is the remedy for it?

5. What historical events are recalled by the following. Give the authors or speakers if you can:—

(*a*) There was a sound of revelry by night.

(*b*) News of battle, news of battle.
Hark, 'tis ringing down the street.

(*c*) This day is called the feast of Crispin.

(*d*) I sent you to contend against men, not against the winds.

(*e*) See, I have taken possession of the land with both my hands.

(*f*) This hand hath offended.

6. In what books do the following characters appear:—

Uriah Heep, Touchstone, Martin Lightfoot, Wamba, Maggie Tulliver, Salvation Yeo, The Knight of the Leopard, John Ridd, Barkis.

7. Why may Henry VII.'s reign be considered as the commencement of modern history?

8. What was Henry VIII.'s attitude to the Reformation? Explain his position clearly.

9. What are the duties of the Local Government Board?

10. Write a short essay on the uses of mountains.

11. Describe with a sketch map a coasting voyage from Christiania to Hammerfest.

12. Where and what are the following:—Yosemite, Yellowstone, Utah, Itasca, Duluth, Ozark, Sacramento, Tampa, Hatteras, Harvard.

13. Explain fully how you can determine the chemical composition of water:—

(*a*) By analysis, and (*b*) by synthesis.

All students are invited to write for assistance on any matter connected with this Course. Letters should be sent to Mr. A. T. FLUX, Belvedere, Kent, and must contain the coupon of the current number of the paper, with a stamped addressed envelope if a reply is needed by post.

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OUR CERTIFICATE COURSE FOR 1907.

BY GEORGE COLLAR, B.A., B.SC.,
Head-Master of Battersea Pupil-Teacher School.

Test Questions on Last Month's Work.

PRINCIPLES OF EDUCATION.

1. Point out some of the inconsistencies of English spelling, and account for their origin.
2. Discuss the proposals for reforming English spelling.
3. Enumerate the classes into which a teacher might arrange the difficulties connected with spelling.

ENGLISH LITERATURE.

1. Discuss the character of Shylock and of Portia.
2. Discuss the following expressions and words:—*By'r lakin, cue, peace-blossom, eyne, welkin,* and *Acheron.*

ENGLISH HISTORY.

1. Trace the rise of Parliamentary power up to the accession of Henry VII.
2. Describe the social condition of the lower classes at the time of Cade's rebellion.
3. Describe the position of affairs on the Continent, and the condition of the principal Powers, at the accession of Henry VII.

GEOGRAPHY.

1. What are the conditions which make a river important, and how does a river benefit the countries through which it flows? Illustrate your answer by reference to the Rhine and Danube.
2. Mention European rivers that rise in glaciers, and give a brief description of a glacier.

ARITHMETIC.

1. Find a fraction whose value does not change on adding 20 to the numerator and 25 to the denominator, and of which 340 is the L.C.M. of the numerator and denominator.
2. State and prove the rule for reducing a recurring decimal to a vulgar fraction.
3. What information respecting the nature of the equivalent decimal fraction can you obtain from the inspection of a given vulgar fraction? Give examples.

ALGEBRA.

Find the factors of the following expressions:—

(i.) x^3+27y^3. (ii.) $x^3+y^3+z^3-3xyz$.
(iii.) x^2-x-12. (iv.) x^3-5x^2+2x+2.

GEOMETRY.

1. Show how to draw a common tangent to two circles which cut one another.
2. Construct a triangle whose angles are in the ratio 7 : 5 : 3, and whose greatest side is of length 6 centimetres. Bisect the greatest angle, and measure the length of the bisector.
3. Describe a parallelogram whose adjacent sides are 4·2 and 5·7 centimetres, and the included angle 103°. Find the area of this parallelogram.

ELEMENTARY SCIENCE.

1. State the three laws of motion, and say to what extent you consider them proved.
2. Explain carefully the second law of motion.

Notes and Syllabus for November.

ENGLISH COMPOSITION.

Study Nesfield's *Senior Composition*, chap. viii. The advice here given on the arrangement of the parts of a sentence, and especially the subordinate clauses of a complex one, is very sound. The student should master the differences between the loose, or disconnected, style of composition and the periodic style. A poor writer does not set out his idea as a grand whole, but gives a part and then adds to it; consequently his sentences resemble those houses which have been completed from the designs of one architect, and enlarged by another in a way that is often out of keeping with the original design. It is not really essential that the sentence should not form a grammatically complete construction until the end is reached, although as a general rule that is the case, just as the first part of a school erected may be used as a complete school in itself, although the whole of the architect's plans may not have been carried out. The reader must not feel that his interest is satisfied until the end of the sentence is reached. The longer a sentence is, the more difficult, and at the same time the more necessary it is to sustain the interest in it to the end.

The structure of the paragraph deserves close attention, for most students are in doubt as to when to begin a new paragraph. Each paragraph should deal with a fresh theme, and it should be noted that, as a rule, pronouns should not be used, or be used only with very great caution, to refer to nouns in the preceding paragraphs.

Prepare essays on the following subjects:—

(i.) Courtesy.
(ii.) The rise of the English drama.
(iii.) "Nature never did betray
The heart that loved her."
(iv.) Socialism.

PRINCIPLES OF EDUCATION.

Study in detail chapter ix. of Collar and Crook's *School Management.*

A study of the mechanism by which the voice is produced is very essential for every teacher, in order that he may know how to produce his own voice with the least exertion and fatigue, and also that he may teach his pupils how to produce their own voices with best effect. These matters are treated of fully in text-books of physiology, which we strongly recommend our readers to study closely, and we here give a short outline of the leading facts, which may serve as a guide to further study. The elements of the science of sound also form a profitable study in this connection.

In the throat is a mechanism formed of a framework of cartilages, consisting of (i.) a ring of cartilage—the *cricoid*—resembling a signet-ring with the largest part at the back; (ii.) a shield-like plate called the *thyroid*, which forms the projection known as the Adam's apple; (iii.) two tetrahedral, or pyramidal, pieces called the *arytenoid cartilages*, resting on the back of the cricoid cartilage, and capable of turning about on their bases. From the points of these cartilages fibrous threads pass across to the thyroid, and are embedded in tissue and covered with mucous membrane. These are the *vocal cords;* the opening between them is the *glottis*, and by turning the arytenoid cartilages the vocal cords may be pressed closer together and the glottis made narrower. When the voice is not being exercised the glottis is triangular, and about a quarter of an inch wide at the widest part; but when the voice is about to be produced the vocal cords are brought so close together that they almost touch, and when they are in this position, and air is driven between them, they vibrate and produce a sound. A similar sound may be produced by placing two fingers close together in front of the mouth and blowing.

The vibrations caused by blowing on a sharp edge or between two surfaces are indefinite and of different rates. They require to be selected and reinforced by proper resonance. Take a tuning-fork, and after striking it hold it over a tall empty jar. There will probably be no result. Pour a little water into the jar and try again. Keep on adding water, and hold the vibrating fork over the jar each time until at last a full rich tone is given out. This occurs when the length of the column of air is a quarter of the wave-length of the note. Although the pitch of the note heard depends largely on the resonance in the larger air passages, it is also affected by the tension of the vocal cords, which can be drawn more tightly by the appropriate muscles—the tighter the cords the higher the pitch.

When a note is sounded on a musical instrument, the sound differs from a note of the same pitch produced by another instrument. This difference is spoken of as *quality* or *timbre*, and is easily noticed on comparing the sound produced by an expert violinist with that produced by a beginner. It arises from the fact that when a note is produced by a string or pipe, in addition to the note produced by the vibration of the whole string, or column of air, there are other notes produced at the same time by the vibration of parts, which blend more or less with the fundamental notes.

When a vowel is sounded a continuous vibration is set up in the larynx, which consists of a principal or fundamental sound mingled with subordinate ones. By appropriately shaping the cavity of the mouth, any one of these subordinate sounds, or *overtones*, can be reinforced, and thus the different vowels are produced. Sound the vowels and notice that the cavity of the mouth is greatest for *a*, as in *father*, and smallest for

u and *e*. In each case the work done by the larynx is the same, and the nasal passages are closed.

In sounding the consonants the stream of air is more or less interrupted, instead of flowing freely. We have, however, a free current of air in aspirating the *h*, and also in sounding *m* and *n*; in the first case the air comes freely from the mouth, in the second the lips are closed and the air passes through the nose, and in the last, although the air passes through the nose, the passage is closed not by the lips, but by pressing the tongue against the front part of the palate. Most of the other consonants are produced by closing the air passage and then forcing it suddenly open. In sounding *p* and *b* the passage is closed by the lips, hence they are called labials; in sounding *t* and *d* the passage is closed by the tongue and front part of the palate, while for *k* and *g* the back part of the tongue and palate are used.

The student should try experiments with himself and notice the organs employed in producing each of these letters. He will also notice that although the lips are employed to form both *p* and *b*, yet the former is produced without any vibration of the larynx, which does vibrate in sounding the latter. Place the fingers on the larynx and sound these letters to see that this is so. A similar difference exists between *t* and *d*, between *chip* and *jet*, and between *k* in *king* and *g* in *give*. Hence *b*, *d*, *j*, and *g* are called *voiced* consonants, and *p*, *t*, *ch*, and *k* are *non-voiced* consonants.

English Literature.

Read Shakespeare's *As You Like It*, and Macaulay's *Essay on Milton*.

This play is one of the most delightful of Shakespeare's to read. The interest centres not in the plot but in the poetry, though the former is sufficient to maintain the interest. We can find great pleasure in the speeches of "the melancholy Jaques," and perhaps these passages are the best known connected passages in Shakespeare. Everybody should know by heart the description of his musing on the "poor sequestered stag," and his comparison of the world to a stage. Everything serves him as food for thought, and he can "suck melancholy out of a song as a weasel sucks eggs."

The delightful love scenes show up the tender and sportive character of Rosalind, which the quiet character of Celia tends to set off.

There are many passages besides the two above mentioned in this play that the student should commit to memory: among them are the Duke's praise of country life, the meeting of Jaques and Touchstone in the forest, and his apology for his melancholy nature, Rosalind's description of the marks of a lover and of the progress of time with different persons, Oliver's account of his rescue by his brother, and the beautiful description of Ganymede at the end of the fourth act.

Study in detail the fourth act of the *Midsummer Night's Dream*.

Scene i. line 19. *Neif*, *i.e.* your fist.

32. *bottle of hay*, a bundle of hay.

38. *Exposition of sleep*. He means an *imposition*—*i.e.* sleep is imposed on him.

48. *Sweet favours*, sweet nosegays.

104. *Our observation is performed*, we have performed our May Day observances.

105. *the vaward* = the vanward, the fore part.

120. *So flewed*, having such large hanging lips. The upper lips of some hounds, such as bloodhounds, hang down very considerably.

so sanded, of such a sandy colour.

122. *Dew-lapped*, having a roll of loose skin on the breast.

131. *I wonder of* = I wonder at.

139. *St. Valentine*. St. Valentine's Day is the 14th of February, and at that time the birds were supposed to pair.

164. *In fancy*, in her fantasy, as a result of her desire.

168. *Gaud*, a showy toy; compare the adj. *gaudy*.

183. *For* = because.

207. *If he go about*, if he takes the trouble.

210. *Potched fool*, a fool clothed in motley, like a court jester.

217. *After death*, *i.e.* after I have died on the stage.

English History.

Take the early Tudor period, *i.e.* all except Elizabeth. York Powell and Tout give a capital account of this period, as do also J. R. Green and Gardiner. In this period European events had a great influence on those in England, and the student should carefully read the account of the development of those countries that played an important part in later British and European history. It is difficult to recommend a book on this subject. Freeman's *First Sketch of European History* contains a large amount of matter, but it is too condensed to form interesting reading. Those who can read French readily will find Lavisse's *Vue Générale de l'Histoire Politique de l'Europe* a very useful book (Paris—Colin, 3 fr. 50).

In studying the policy of Henry VII. the reader should note that Henry really gained the throne through the weakness of the Yorkists, caused by the dislike so many felt towards their leader, Richard III. Hence Henry tried to unite the rival parties and to keep down the military power of the nobles; with this end he re-enacted laws against livery and maintenance, which were enforced by the Court of Star Chamber, whose exactions practically enabled him to govern without a parliament. He took a great interest in commerce, and endeavoured by fostering it to promote the prosperity of the country. He assisted the wool trade with Flanders by negotiating the treaty known as *Malus Intercursus*, 1496. Henry aimed at strengthening his position by foreign marriages as well as by treaties. Thus he brought about the marriage of his daughter Margaret with the King of Scotland, and of his son Arthur (and afterwards of Henry) with Catharine of Aragon. He aimed at preserving the "balance of power" on the Continent, and this theory, which was first thought out by Wolsey, played a very important part in later European history. Note the important part played in English history by Dudley, the Baron of the Exchequer and agent in Henry VII.'s extortions, Margaret of Burgundy, Cardinal Morton, and Sir Edward Poynings, who was Lord-Deputy of Ireland 1494–96, and who passed the celebrated law, which remained in force till 1782, which made the Irish Parliament subordinate to the English Parliament.

Many foreign contemporaries of Henry VII. are men of world-wide fame, and their biographies should be read up in the dictionary of biography or in the encyclopædia. Among these are Pope Julius II.; Ferdinand of Aragon, who married Isabella of Castile, conquered Granada from the Moors, and sent Columbus on his voyages of discovery; the Emperor Maximilian, and the Emperor Charles V.; in religious matters there were Martin Luther, the German Reformer, Zwingli, the Reformer of Zurich, and Calvin, who worked in Geneva (though the last was not born till the year Henry VII. died), and Ignatius Loyola, the founder of the order of the Jesuits; the great writers, Ariosto, Machiavelli, and Philip Commines; the great masters in the world of art—Raphael, Michael Angelo, Albert Dürer, Leonardo da Vinci, and Holbein.

The reign of Henry VIII. centres round the biographies of the king and of Wolsey. Wolsey was a skilful administrator, a capable diplomatist, and a far-seeing politician.

The work of unravelling the connection between the royal divorce and the Reformation will exercise the student for as much time as he is prepared to devote to it. The social and political effects of the Dissolution of the Monasteries should be noted.

Geography.

Study in detail the physical features of the British Isles. Many of these can be entered on a map, and the map of the British Isles should be repeated until the positions of all the chief capes, bays, rivers, and mountains have been thoroughly mastered. There are some important physical features which cannot easily be shown on a map; among these are climate, rainfall, and geological formation, although the latter is indicated on special maps. Many students fail to give a satisfactory account of the climate and rainfall of a place, because they are ignorant of the effects of compressing and rarefying air. Those of our readers who have ever pumped up a bicycle tyre know that the nozzle of the pump becomes very hot. This is due to compression. On the other hand, if the bicycle has been standing in a room for some hours the air in the tyre will be of the same temperature as the room, which will be shown by a thermometer in the room; but if the cap of the valve be removed so as to allow the air to come out in a stream, it will be found, if the compressed air is made to play on a thermometer, as it expands a very considerable fall of temperature will be recorded. This shows that by compressing the air heat is produced, but by allowing it to expand cold is produced. This principle is employed in the refrigerating machinery on the ships that bring meat from New Zealand and Argentina. Air is pumped out from the freezing chambers, and the temperature falls owing to the expansion; and again, as air is allowed to enter the chamber it expands and cold is produced, so by both operations the meat is cooled. Now, the reason that it is cold on the top of a mountain may be partly that owing to the increase of surface there is more radiation going on from a given mass, but the chief reason is that when a current of air strikes against a mountain the air has to rise and

flow over the top. As the air rises it reaches regions where the pressure is less, and consequently it expands. This expansion results in cooling, and if the air is laden with watery vapour the vapour is condensed first into clouds and then into rain. Thus mountains do not really attract clouds, but clouds are formed on them when the wind blows towards the mountain; then we see the spectacle of the

"Mountains on whose barren breast
The labouring clouds do often rest."
—*Milton.*

The moisture in the air may be condensed into cloud or fog by meeting with a cold wind, though this is not very common in this part of the world, and by passing over a cold ocean current, as happens off the coast of Newfoundland. It must be remembered that a cloud consists of minute drops of liquid water, not vapour. These drops remain in the air for two reasons. (i.) The resistance offered by the air depends on the size of the *surface* of the drop, which is proportional to the *square* of the radius, while its weight depends upon its volume, which is proportional to the *cube* of the radius; hence, as we diminish the size of a drop the weight to be supported falls off much more rapidly than the resistance which tends to keep it up. (ii.) When watery vapour or steam condenses to liquid it gives out a considerable amount of heat. If the air is still this heat is communicated to the air in contact with the drop, and makes that air expand. This light air then helps to keep up the little drop of water which it surrounds.

Applying these principles to the British Isles, we notice that the prevailing winds are from the south-west. These are well supplied with watery vapour as they come from off the ocean. As the chief land elevations are in the west and south-west, this moisture is condensed there in large part, and we find the greatest rainfall in those districts, while the east coast for converse reasons is comparatively dry. Compare the mean rainfall for November at Ben Nevis (15·7 in.) and Fort-William (7·8 in.) with that of Leith (2·1 in.), and that of Seathwaite, Cumberland (13·8 in.), with that of Lincoln (1·8 in.). If the student studies the weather charts in the *Times* or other paper in which they are given, he will often find that the wind in different parts of a fairly large area is blowing towards the centre of the area, and at other times it is blowing away from the centre. The former condition constitutes what is called a cyclone, while the latter constitutes an anticyclone. The recorded observations refer to the wind near the surface of the earth, and it is evident that in the case of a cyclone the air which blows towards the centre must escape from the area by rising and flowing away in upper currents. Hence, when a cyclone centre is moving over the country there is a probability of rain, because the moist air rises and cools. On the other hand, in an anticyclone the air *descends* as it blows outwards, and so becomes warmer and does not condense the vapour it contains. The cyclones moving from eastward from the Atlantic not only cause a marked difference between the climate of the east and west of Great Britain, but affect the climate of Europe in the same way.

Arithmetic.

Study the chapters on Averages and Percentages. The following sum is taken from this year's papers:—

Of a company's capital 16 *per cent. was invested in a farm,* 28 *per cent. in ships,* 36 *per cent. in a railway, and the rest in minerals. When the ships had risen in value* 22½ *per cent., the railway had risen* 30 *per cent., but the farm had fallen in value* 12½ *per cent. The company was just as rich as before. How much had the minerals fallen in value?*

Work the same sum if the value of the ships, railway, and farm had risen in value x *per cent.,* y *per cent., and* z *per cent. respectively.*

Owing to the elliptical manner in which the statement is made, many students assume that the percentages are all percentages of the same thing. Now, the first four are actually stated to be percentages "of the company's capital," but the 22½ per cent. that the value of the railway increases is not 22½ per cent. of the company's capital, so the new value of the railway is *not* (36 + 22½) per cent. of the company's capital, but (36 + 22½ per cent. of 36) per cent. of that.

(*a*) Original value of minerals = (100 − 16 − 28 − 36) per cent. of the capital = 20 per cent. of the capital.

(*b*) New value of farm = (16 − 12½ % of 16) % = 14 % of capital.
(*c*) " ships = (28 + 22½ % of 28) % = 34·3 % "
(*d*) " railway = (36 + 30 % of 36) % = 46·8 % "
(*e*) ∴ By balance, the new value of minerals = 4·9

100

Hence the value of the minerals fell from 20 per cent. of the capital to 1·5 per cent. of the capital.

The loss equals ∴ $\frac{15 \cdot 1}{20}$ of 100 per cent. Ans. 75·5 per cent.

Having worked out the results for particular values, it is easy to substitute the general values:—

(*b*) $(16 - x$ per cent. of $16) = 16 - \frac{4x}{25}$ per cent.

(*c*) $(28 + y$ per cent. of $28) = 28 + \frac{7y}{25}$ per cent.

(*d*) $(36 + z$ per cent. of $36) = 36 + \frac{9z}{25}$ per cent.

(*e*) ∴ new value of minerals equals

$$100 - \left(16 + 28 + 36 + \frac{9z + 7y - 4x}{25}\right) \text{ per cent.}$$

$$= \left(20 - \frac{9z + 7y - 4x}{25}\right) \text{ per cent.}$$

∴ The loss per cent. on the minerals equals

$$\frac{9z + 7y - 4x}{25 \times 20} \text{ of } 100 = \frac{9z + 7y - 4x}{5}.$$

To check the work, we substitute the particular values of x, y, and z, and obtain 75·5 as before.

Algebra.

Prepare the chapter on H.C.F.

Geometry.

Revise the *theorems* in the first book of Euclid.

General Elementary Science.

Study the chapter on gravity, gravitation, density, weight, specific gravity.

Gravitation is the tendency that all bodies have to attract other bodies towards their centres. It was proved by Newton that the force of gravity exerted between two bodies was proportional to the product of their masses divided by the square of their distances. Newton proved this by means of the simple laws of motion combined with observations on the moon's orbit. Now, according to the first law, unless a force were acting on the moon it would continue to move in a straight line, *i.e.* in a tangent to its orbit; but it is pulled out of this straight line by the attraction of the earth, and knowing the distance of the moon to be about 240,000 miles, or thirty times the radius of the earth, it follows that if the law of gravity is true the moon should move towards the earth a distance equal to $\frac{1}{30 \times 30}$ part of the distance a body near the earth's surface would move; and we know from observation how much this is, so by calculating the distance set up between the moon's actual position and the position it would have if it moved off at a tangent, it is shown that the two agree.

Few students have a very clear conception of the nature of density. Of course, in ordinary language we imply by density the closeness with which the particles are packed; but this is not exact enough for science. If we wish to compare the density of lead with the density of iron, what do we know about the particles, and how can we measure the distance between them or the closeness with which they are packed? If, however, we adopt as our definition that "density is the weight of a unit volume," we have something that we can measure and express in figures. It must be observed that nothing is here said about the units employed in measuring the weight and the volume, so we might employ different numbers to represent the density of the same substance if we only vary the units. This makes it imperative to use the same units when we wish to compare two densities.

Now, if we use the c.cm. as the unit of volume, and the gramme as the unit of weight, we can define the density of a substance as the weight in grammes of a c.cm. of it. But by the definition of the gramme, a c.cm. of water weighs one gramme, and hence with these units the density of water is 1. Consequently, if we divide the weight of a c.cm. of any substance by 1 gr. (*i.e.* the weight of 1 c.cm. of water), we obtain an abstract number which shows how many times a given portion of the substance is heavier than the weight of an equal volume of water. This number, or quotient, is called the *specific gravity* of the body.

Specific gravity is often confused with density, but the two are quite distinct, as we could talk of the density of a body without any reference to another body. If we use the gramme and c.cm. as the units, then it follows that the specific gravity of a body is the weight in grammes of a c.cm. of it.

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MATHEMATICS.

(STAGES 2 AND 3.)

BY FRANK CASTLE, M.I.M.E.,

Royal College of Science; Lecturer on Mathematics, etc., Morley College; Author of "Elementary Practical Physics," "Practical Mathematics," etc.

Ex. 6. (*a*) Find the roots of the equation

$$x^2-2ax+(a-b)(a+b)=0.$$

(*b*) Form the equation whose roots are the squares of the roots of that equation

(*a*) $x^2-2ax+(a-b)(a+b)=0,$

or $x^2-2ax+a^2-b^2=0;$

$\therefore\ x^2-2ax+a^2=b^2.$

Hence $x-a=\pm b;$

$\therefore\ x=a+b$ or $a-b.$

(*b*) Let α and β be the roots required.

$\therefore\ (x-\alpha)(x-\beta)=0,$

but $\alpha=(a+b)^2,$

and $\beta=(a-b)^2;$

$\therefore\ \{x-(a+b)^2\}\{x-(a-b)^2\}=0.$

Hence the required equation is

$$x^2-2(a^2+b^2)x+(a^2-b^2)^2=0.$$

Ex. 7. Solve the equation

(*a*) $x^2-5x+6=24-2\sqrt{(x^2-5x+6)}.$

(*b*) Transform the equation

$$x(x+1)(x+2)(x+3)=9\frac{9}{16}$$

by substituting $y-\frac{3}{2}$ for x, and thence find all the values of x which satisfy the equation. (1901)

Ans. $\frac{5\pm\sqrt{65}}{2};\ \frac{5\pm\sqrt{145}}{2}.$

Ex. 8. (*a*) If α and β are the roots of the equation $ax^2-bx+c=0$, show, without solving the equation, that $\alpha(\alpha+\beta)=b$, and $\alpha\alpha\beta=c$.

(*b*) Find the equation whose roots are the squares of the roots of the equation

$$x^2-x\sqrt{(2\sqrt{c}+b)}+\sqrt{c}=0. \quad (1902)$$

Ex. 9. (*a*) Explain how to solve the equation $ax^2-bx+c=0$, and find the condition that the roots be real and unequal.

(*b*) Find whether the equation $101x^2-143x+51=0$ has real roots. (1904)

Ex. 10. Find all the roots of the equations:—

(*a*) $\sqrt{(x+4)}+\sqrt{(2x+10)}=\sqrt{2}.$

(*b*) $x^4-4x+3=0.$

(*c*) $x+\frac{4a}{x+1}=2a+1.$ (1899)

Ans. (*a*) -4; (*b*) $1, 1, -1\pm\sqrt{-2}$; (*c*) 1 or $2a-1$.

Ex. 11. Solve the equations

(*a*) $\frac{4x}{x-1}-\frac{19}{2x^2-2}=\frac{10}{x+1}.$

(*b*) $4xy=b^2,\ x+z=2a,\ y+z=a.$ (1899)

Ans. (*a*) $\frac{3\pm\sqrt{7}}{4}.$

(*b*) $x=\frac{a\pm\sqrt{a^2+b^2}}{2},\ y=-\frac{a\pm\sqrt{a^2+b^2}}{2},\ z=\frac{3a\pm\sqrt{a^2+b^2}}{2}.$

Equations.—It is advisable to consider equations of a somewhat more difficult character. It is impossible to give any general rule or rules which are applicable to all cases; practice is necessary to enable the solution of even a comparatively simple equation to be obtained easily and readily. Such practice is, if possible, still more important in more difficult cases to ascertain the particular method which leads to a solution.

Even assuming that a solution could be found by the use of a general method, it would frequently be found that the work involved would be both unwieldy and cumbersome, and the particular method by which the solution would be readily obtained would not be obvious except by means of consistent practice.

Ex. 1. Solve the equation

$$\sqrt{(3x+4)}+\sqrt{(2x-5)}=2. \quad (1903)$$

This may be written

$$\sqrt{(3x+4)}=2-\sqrt{(2x-5)}.$$

Squaring, $3x+4=4-4\sqrt{(2x-5)}+2x-5,$

or $x+5=-4\sqrt{(2x-5)}.$

Squaring, $x^2+10x+25=32x-80,$

or $x^2-22x+105=0;$

$\therefore\ (x-15)(x-7)=0;$

$\therefore\ x=15,$ or $x=7.$

Ex. 2. Solve the following equations:—

(i) $3x^2-10\sqrt{3x}+12=0.$

(ii) $a(a-b)x^2-(a^2+ab+b^2)x+3b(a-b)=0.$

(iii) Find what quantity can be substituted for a in the fraction $\frac{(a-2)^2}{a-3}$ without altering its value. (1902)

(*a*) $3x^2-10\sqrt{3x}+12=0,$

or $x^2-\frac{10}{3}\sqrt{3x}+\left(\frac{5}{\sqrt{3}}\right)^2=-4+\frac{25}{3}=\frac{13}{3};$

$\therefore\ x=\frac{5\sqrt{3}}{3}\pm\frac{\sqrt{39}}{3}.$

(ii) $a(a-b)x^2-(a^2+ab+b^2)x+3b(a-b)=0.$

This may be arranged in the form

$$\{(a-b)x-3b\}\{ax-(a-b)\}=0.$$

Hence $(a-b)x-3b=0,$

or $ax-(a-b)=0.$

From the former, $ax=a-b;$

$\therefore\ x=\frac{3b}{a-b}$

From the latter, $ax=a-b;$

$\therefore\ x=\frac{a-b}{a}$

Ex. 3. (*a*) Show that the expression ax^2+bx+c has the same sign as a for all values of x, except those which lie between the roots of the equation

$$ax^2+bx+c=0.$$

(*b*) Find the condition that the roots of the equation

$$a(1-x^2)+2bx+c(1+x^2)=0$$

may be equal.

(*c*) Find the range of values of a, for which both the roots of the equation

$$x^2-2ax+a^2-1=0$$

are less than 4 and greater than -2. (1902)

(*b*) $a(1-x^2)+2bx+c(1+x^2)=0,$

or $a-ax^2+2bx+c+cx^2=0;$

$\therefore\ x^2(c-a)+2bx+c+a=0.$

Hence the roots are equal if $b^2=(c+a)(c-a)=c^2-a^2;$

i.e. if $a^2+b^2=c^2.$

(*c*) The solution of the equation $x^2-2ax+a^2-1=0$ gives

$$x=a\pm\sqrt{a^2-a^2+1}=a\pm1.$$

If both roots are to be less than 4, then a must be less than 3.
If both roots are to be greater than -2, then a must be greater than -1.

Ex. 4. (*a*) Form the equation whose roots are 1 and $\frac{p-q}{q-r}$.

(*b*) Solve the equation

$$(x-2)(x-4)=n,$$

and write down four values of n, for each of which at least one of the values of x will be a positive whole number. (1902)

(*a*) The roots are 1 and $\frac{p-q}{q-r}$.

$\therefore$ sum of roots $=1+\frac{p-q}{q-r}=\frac{q-r+p-q}{q-r}=\frac{p-r}{q-r}$

Product of roots $=1\times\frac{p-q}{q-r}=\frac{p-q}{q-r}$

$\therefore$ Required equation becomes

$$x^2-\frac{p-r}{q-r}x+\frac{p-q}{q-r}=0,$$

or $x^2(q-r)-(p-r)x+p-q=0.$

(*b*) $(x-2)(x-4)=n;$

$\therefore\ x^2-6x+8=n,$

or $x^2-6x+8-n=0.$

$$x=3\pm\sqrt{9-8+n}=3\pm\sqrt{n+1}\ .\ .\ .

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NOTES ON PHYSICS.

BY EDWIN EDSER, A.R.C.SC.

Author of "Heat for Advanced Students," "Light for Students," "Differential and Integral Calculus for Beginners," etc.

General Physics.

Moments of Inertia (*continued*).—In the October number of the *Practical Teacher* (pp. 212–214), a number of the most important moments of inertia were evaluated. In each case considered the axis passed through the centre of gravity of the body; we must now consider the case where the axis is at a definite distance from the centre of gravity.

Let us first obtain the moment of inertia of a thin rod AB (Fig. 1), about an axis through D and perpendicular to the plane

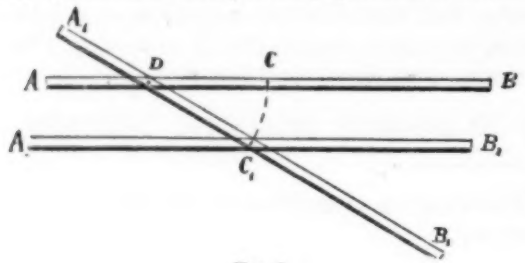

FIG. 1.

of the paper; the perpendicular distance CD from the centre of gravity C of the rod to the axis being equal to h. Let us suppose that the rod is turning with a uniform angular velocity ω about the axis through D; and after a short interval of time let the rod attain the position A_1B_1. The same position would have been attained if the rod had first moved to the position A_2B_2, remaining parallel to its original position AB, while its centre of gravity described the circular arc CC_1 with D as centre; and then rotated about C_1 to the position A_1B_1. Each successive stage in the rotation of the rod about D may similarly be accomplished by a motion of the rod such that it remains parallel to itself, together with a rotation about its centre of gravity. It is easily seen that the angle $B_2C_1B_1$, through which the rod rotates about its centre of gravity, is equal to the angle subtended at D by the arc CC_1, which the centre of gravity describes; hence the angular velocity of rotation of the rod about its centre of gravity is equal to the angular velocity with which the centre of gravity revolves about D. It follows that the total kinetic energy of the rod is made up of two parts. One is due to the motion of the centre of gravity of the rod, with angular velocity ω, around a circle of radius $DC=h$; the linear velocity of the centre of gravity of the rod is equal to $h\omega$, and if M is the mass of the rod, the corresponding kinetic energy is equal to $\frac{1}{2}M(h\omega)^2$. The other part of the kinetic energy is due to the rotation of the rod, with angular velocity ω, about its centre of gravity; if I_1 is the moment of inertia of the rod about an axis through C and perpendicular to the plane of the paper, the kinetic energy due to its rotation about C is equal to $\frac{1}{2}I_1\omega^2$ (see *Practical Teacher*, October 1906, p. 212).

Now let I be the required moment of inertia of the rod about an axis through D and perpendicular to the plane of the paper; then the total kinetic energy due to its rotation about D with angular velocity ω is equal to $\frac{1}{2}I\omega^2$. Hence

$$\frac{1}{2}I\omega^2=\frac{1}{2}Mh^2\omega^2+\frac{1}{2}I_1\omega^2.$$

$$\therefore\quad I=Mh^2+I_1 \qquad \ldots\ldots\ldots\ldots (1)$$

The reasoning used above applies, not alone to a rod, but to a body of any shape whatever; hence we obtain the general rule that **the moment of inertia I of a body about any assigned axis is equal to the mass M of the body multiplied by the square of the distance h from the axis to the centre of gravity, *plus* the moment of inertia I_1 of the body about a parallel axis passing through the centre of gravity of the body.**

Let us apply this rule in the determination of the moment of inertia of a rod of mass M and length l about an axis through one of its ends and perpendicular to its length. The distance from the axis to the centre of gravity of the rod is equal to $l/2$; therefore the first term on the right of (1) acquires the value $Ml^2/4$. The moment of inertia I_1 of the rod, about an axis through its centre of gravity and perpendicular to its length is equal to $Ml^2/12$ (*Practical Teacher*, October 1906, p. 213). Hence the required moment of inertia is equal to

$$Ml^2\left(\frac{1}{4}+\frac{1}{12}\right)=\frac{Ml^2}{3}.$$

To check the accuracy of this result, note that the required moment of inertia is equal to *half* that of a rod of mass 2M and length $2l$, about an axis through its centre of gravity and parallel to its length, *i.e.* to

$$\frac{1}{2}\frac{(2M)(2l)^2}{12}=\frac{Ml^2}{3}.$$

Moment of inertia of a bar of finite cross-section about an axis through the centre of gravity of the bar and perpendicular to its length.

Let it be required to find the moment of inertia of the bar represented in Fig. 2 about the axis AB drawn through its

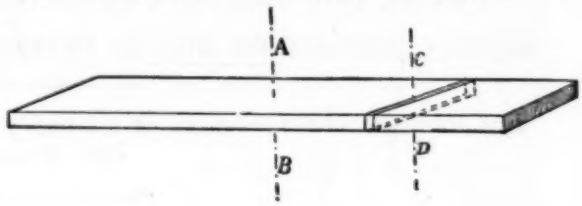

FIG. 2.

centre of gravity and perpendicular to its length. Let the total length of the bar be l, while its mass is M and its breadth is b. (The *breadth* is the measurement across the bar in a direction perpendicular to its length and to the axis AB.) Let the bar be divided into a large number n of equal slices by imaginary planes perpendicular to its length. The total moment of inertia of the bar about the axis AB will be equal to the sum of the moments of inertia of the various slices about the same axis. Now the moment of inertia of any slice about the axis AB will be equal to the mass of the slice multiplied by the square of the distance of its centre of gravity from AB, *plus* the moment of inertia of the slice about an axis CD passing through its own centre of gravity and parallel to AB. If we multiply the mass of each slice by the square of the distance of its centre of gravity from AB, the sum of the terms so obtained will have the same value as the moment of inertia of a thin rod, of which the mass and length are equal to those of the bar; *i.e.* it will be equal to $Ml^2/12$. Since the slices are thin, the moment of inertia of one about an axis through its own centre of gravity, and parallel to AB, will be equal to the mass multiplied by $(b^2/12)$ (see *Practical Teacher*, October 1906, p. 213). The mass of each slice will be $M/n=m$ (say); the moment of inertia of a slice about an axis through its centre of gravity, and parallel to AB, will be equal to $mb^2/12=(Mb^2/12n)$, and the sum of these moments of inertia will be equal to

$$n\cdot\frac{M}{n}\cdot\frac{b^2}{12}=\frac{Mb^2}{12}.$$

Hence the total moment of inertia I of the bar about the axis AB will be given by the equation

$$I=M\frac{l^2+b^2}{12}. \qquad \ldots\ldots\ldots (2)$$

It must be noticed that the *depth* of the bar (*i.e.* the measurement across the bar in a direction parallel to the axis AB) does not occur explicitly in (2); the depth only affects the moment of inertia in so far as it affects M, which is, of course, proportional to the depth.

When b is small in comparison with l, b^2 may be neglected in comparison with l^2. When b^2 cannot be neglected in comparison with l^2, the moment of inertia of the bar is equal to that of a thin rod of the same mass, and of length equal to the distance between opposite angles of the rectangular surface perpendicular to the axis AB. (This is obvious when we remember that the distance between the opposite angles is equal to $\sqrt{l^2+b^2}$.) This result should be remembered when the moment of inertia of a rectangular bar magnet has to be calculated.

Exercise 1.—Using reasoning similar to that explained above,

SCHOOL LIBRARIES

What is the Cost? What are the best Books?

So many eloquent pens have already shown the importance of the school library as an adjunct to, and indeed as part and parcel of, the educational system, that it were a work of supererogation to insist upon that point further. But there is still something to be said on the question of the choice of books for the school library, and though in this, as in other matters, there is no use arguing about tastes, it is perhaps possible to set forth certain considerations that will meet with general approval.

The purpose of the school library being to foster a love of reading in children, and thus to widen their minds and help them to become intelligent and useful citizens, it is obvious that no success can be achieved unless the children are first **interested.** Now in what are children interested? To begin with, in fairy tales and stories about children—the marvellous and the natural, which seem to them in no way inconsistent. What child has not revelled in **Grimm's Fairy Tales**, in Miss Sinclair's **Holiday House,** in Captain Marryat's **Children of the New Forest!** Then, as their circle of experience grows, they become interested in animals, in natural history, in voyages and discoveries; they form ideals, and cherish their favourite heroes, and, reading about these, they are drawn on to read the romance of history generally. It is at this period that such books as Anson's and Cook's **Voyages, Robinson Crusoe,** Waterton's **Wanderings,** and Southey's **Life of Nelson** make a strong appeal. With still wider knowledge, the boys and girls towards the end of school life begin to take an interest in the literature of ideas: then Addison's **Spectator** and Macaulay's **Essays** open a world of thought to them, and they are helped towards the formation of a critical taste. The great point to bear in mind in the selecting of books is that **children who grow up with the best will never care for the worst;** good reading is the foundation of taste.

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find the moment of inertia of a heavy cylinder of mass M, length l, and circular cross-section of radius r, about an axis passing through the centre of gravity of the cylinder in a direction perpendicular to its length.

Ans. $M\left(\frac{l^2}{12}+\frac{l^2}{4}\right)$

Exercise 2.—What would be the moment of inertia of the cylinder in Exercise 1 if it were hollow, the internal radius being r, the external radius R, and the axis the same as before?

Ans. $M\left(\frac{l^2}{12}+\frac{R^2+r^2}{4}\right)$

Exercise 3.—Find the moment of inertia of a hollow cubical vessel with thin walls, the mass of the vessel being M, the length of an edge being l, and the axis passing through the centre of gravity of the vessel in a direction perpendicular to two opposite faces.

Ans. $\frac{8}{9}Ml^2$

Suggestion.—Each of the faces perpendicular to the axis contribute an amount equal to $\frac{M}{6}\cdot(2l^2)$. Each of the remaining four faces contributes an amount equal to

$$\frac{M}{6}\left\{\frac{l^2}{12}+\left(\frac{l}{2}\right)^2\right\}$$

Moment of inertia of a thin spherical shell about a diameter as axis.—Let the two concentric circles in Fig. 3 represent the

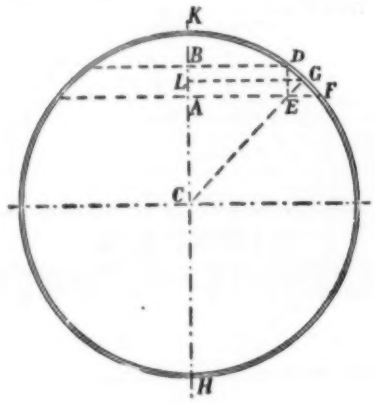

FIG. 3.

sections of the external and internal surfaces of the spherical shell, by a plane passing through the diameter HK which is to serve as axis. Through C, the centre of the sphere, draw a line perpendicular to HK, and let this line represent the section of a plane through C perpendicular to HK. This plane divides the spherical shell into two equal parts. Then it is clear that the moment of inertia of the whole spherical shell about HK as axis will be twice as great as the moment of inertia of either half of the spherical shell about the same axis. We may, therefore, proceed to determine the moment of inertia of one of these halves of the shell.

Divide the axis CK into a very large number of parts, and let AB be one of these parts: AB is supposed to be very small, although in Fig. 3 it is represented large so as to render the diagram intelligible. Through A and B draw lines perpendicular to HK, representing the sections of planes perpendicular to the axis. Each of these planes will intersect the spherical shell in a circle, and the two planes will cut off from the shell a circular strip of breadth DF and average length $2\pi\times$GL, where G is some point between D and F, and GL is drawn perpendicular to HK. DF may be considered to be a short straight line.

Let M be the total mass of the shell, while m is its mass per unit area; then $M=4\pi r^2m$, where r is the radius of the shell which is supposed to be so thin that its internal and external radii are practically equal.

The area of the strip cut off from the shell by the planes through A and B is equal to DF $\times 2\pi$GL, and its mass is m times as great. Through D draw DE perpendicular to AF, and join G and C. Then, since DE is perpendicular to GL, and DF is perpendicular to GC, it follows that the angle FDE is equal to the angle CGL, and the right-angled triangles FDE and CGL are similar. Hence

$$\frac{DF}{DE}=\frac{GC}{GL}\quad\therefore\quad DF=\frac{GC}{GL}\cdot DE,$$

and $$2\pi m\,.\,GL\,.\,DF=2\pi mGL\,.\,\frac{GC}{GL}\,.\,DE=2\pi m\,.\,GC\,.\,DE$$

$$=2\pi mr\,.\,DE=2\pi mr\,.\,AB.$$

The moment of inertia of the strip about HK is equal to the mass of the strip multiplied by the square of GL, or to

$$2\pi mr\,.\,AB.(GL)^2=2\pi mr\,.\,AB.\{(GC)^2-(CL)^2\}$$
$$=2\pi mr\,.\,AB.\{r^2-(CL)^2\}.$$

Let $CA=x_a$, while $CB=x_b$. Then $AB=x_b-x_a$, and $(CL)^2$ may be taken as equal to

$$\frac{x_b^2+x_bx_a+x_a^2}{3},$$

since the value of this expression is greater than that of $x_a^2=(CA)^2$, and less than that of $x_b^2=(CB)^2$, and A is supposed to be at an infinitesimal distance from B (the student should refer to the remarks made on page 213, *Practical Teacher* for October 1906, near the top of the right-hand column); therefore the moment of inertia of the circular strip of which DF is the section is equal to

$$2\pi m\,.\,r(x_b-x_a)\left\{r^2-\frac{x_b^2+x_bx_a+x_a^2}{3}\right\}$$

$$=2\pi mr^2(x_b-x_a)-\frac{2\pi mr}{3}(x_b^3-x_a^3).$$

Let us now suppose CK to be divided up into a very great number of parts, by points at distances $x_0, x_1, x_2 \ldots x_{n-1}, x_n$ from C; where $x_0=0$, and $x_n=CK=r$. Then we can write down the moment of inertia of the circular strip cut off from the shell by planes through each pair of neighbouring points, and add these moments of inertia together to obtain that of half the shell. Writing these moments of inertia one under another, we have—

$$2\pi mr^2(x_1-x_0)-\frac{2\pi mr}{3}(x_1^3-x_0^3)$$

$$2\pi mr^2(x_2-x_1)-\frac{2\pi mr}{3}(x_2^3-x_1^3)$$

$$2\pi mr^2(x_3-x_2)-\frac{2\pi mr}{3}(x_3^3-x_2^3)$$

. . . . . .

. . . . . .

$$2\pi mr^2(x_{n-1}-x_{n-2})-\frac{2\pi mr}{3}(x_{n-1}^3-x_{n-2}^3)$$

$$2\pi mr^2(x_n-x_{n-1})-\frac{2\pi mr}{3}(x_n^3-x_{n-1}^3).$$

Adding these together, we obtain

$$2\pi mr^2\,(x_n-x_0)-\frac{2\pi mr}{3}\,(x_n^3-x_0^3)$$

$$=2\pi mr^4-\frac{2\pi}{3}mr^4=\frac{4\pi m}{3}r^4,$$

and the total moment of inertia of the shell is equal to twice this value, or to

$$\frac{8\pi mr^4}{3}=4\pi r^2m\,.\,\frac{2r^2}{3}=\frac{2Mr^2}{3}$$

This is the required moment of inertia of the thin spherical shell.

Moment of inertia of a solid sphere about a diameter as axis.—Divide the sphere into a large number of thin spherical shells by means of concentric spheres of radii $r_0, r_1, r_2 \ldots r_{n-1}, r_n$, where $r_0=0$, and $r_n=r$ the radius of the solid sphere. Let ρ be the density (mass per unit volume) of the sphere; then if M is the mass of the solid sphere,

$$M=\frac{4}{3}\pi\rho r^3.$$

The mass of a thin spherical shell bounded by spheres of radii r_a and r_b will be equal to $4\pi\rho r_{ab}{}^2.(r_b-r_a)$, where the value of

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r_{ab}^2 must lie between r_a^2 and r_b^2. The moment of inertia of this shell about a diameter as axis will be equal to

$$\frac{2}{3}4\pi\rho r_{ab}^2 \cdot (r_b - r_a) r_{ab}^2 = \frac{8\pi\rho}{3} r_{ab}^4 (r_b - r_a),$$

from the result obtained above for a spherical shell. Now we may take

$$r_{ab}^4 = \frac{1}{5}(r_b^4 + r_b^3 r_a + r_b^2 r_a^2 + r_b r_a^3 + r_a^4),$$

since this value obviously lies between that of r_b^4 and that of r_a^4. Hence moment of inertia of spherical shell

$$= \frac{8\pi}{3} \cdot \frac{\rho}{5} \cdot (r_b^4 + r_b^3 r_a + r_b^2 r_a^2 + r_b r_a^3 + r_a^4)(r_b - r_a)$$

$$= \frac{8\pi\rho}{15}(r_b^5 - r_a^5).$$

We can now write down the moments of inertia of the various spherical shells into which the solid sphere has been divided; writing these one under another, we obtain

$$\frac{8\pi\rho}{15}(r_1^5 - r_0^5),$$

$$\frac{8\pi\rho}{15}(r_2^5 - r_1^5),$$

$$\frac{8\pi\rho}{15}(r_3^5 - r_2^5),$$

. . . . .

. . . . .

$$\frac{8\pi\rho}{15}(r_{n-1}^5 - r_{n-2}^5),$$

$$\frac{8\pi\rho}{15}(r_n^5 - r_{n-1}^5).$$

Adding these together, and remembering that $r_n = r$ the radius of the solid sphere, and $r_0 = 0$, we obtain

$$\frac{8\pi\rho}{15}(r_n^5 - r_0^5) = \frac{8\pi\rho}{15} r^5$$

$$= \frac{4\pi\rho r^3}{3} \cdot \frac{2}{5} r^2 = \frac{2Mr^2}{5},$$

which gives us the required moment of inertia of a sphere of mass M and radius r, about a diameter as axis.

Radius of Gyration.—If the whole mass of a body is at a uniform distance from the axis of rotation, the moment of inertia of the body will be obtained by multiplying the mass of the body into the square of this distance. Let it be supposed that the mass of any given body can be redistributed so that it is at a uniform distance K from the axis, the value of K being chosen so that the moment of inertia is not changed. Then if I is the moment of inertia of the body, and M its mass, we have

$$MK^2 = I \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

Each of the formulæ we have previously obtained for the moments of inertia of symmetrically shaped bodies contains M, the mass of the body, as a factor; hence I, on the right of (3), will contain M as a factor, and since the same factor occurs on the left-hand side this factor can be cancelled out, and we obtain the value of K^2 in terms of the dimensions of the body. K is called the **radius of gyration** of the body about the given axis. It is easily seen that for a sphere of radius r, with a diameter as axis, K^2 is equal to $2r^2/5$. For a thin spherical shell, of mean radius r, with a diameter as axis, $K^2 = 2r^2/3$, and so on. As we shall see in succeeding articles, the solution of many problems can be facilitated by expressing the moment of inertia of a body in the form MK^2. The following table gives the value of K^2 for a number of bodies of regular shape :—

VALUES OF K^2, THE SQUARE OF THE RADIUS OF GYRATION.

Thin rod, with perpendicular axis through middle	$l^2/12$
Thin rod, with perpendicular axis through end	$l^2/3$
Circular ring, with perpendicular axis through centre	r^2
Circular ring, with diameter as axis	$r^2/2$
Rectangular bar, with axis through c. of g. and perpendicular to face of length l and breadth b	$(l^2+b^2)/12$
Circular plate, with perpendicular axis through centre	$r^2/2$
Circular plate, with a diameter as axis	$r^2/4$
Cylinder about geometrical axis	$r^2/2$
Cylinder about perpendicular axis through c. of g.	$(l^2/12)+(r^2/4)$
Sphere about diameter	$2r^2/5$
Thin spherical shell about diameter	$2r^2/3$

Light.

The Magnifying Power of a Telescope.—The magnifying power of a telescope was discussed, from an analytical point of view, in the *Practical Teacher* for June 1906 (p. 658). Mr. H. Sands, one of my students at the Goldsmiths' College, New Cross, has worked out a graphical method of solving the same problem. I do not remember to have seen this method published, although it is possible that many teachers have used it; at any rate I feel confident that an account of it in these pages will prove useful to students of physics.

The magnifying power of a telescope is the ratio of the angle subtended at the eye by the image, to the angle subtended at the eye by the object from which the image is derived.

The principles used in what follows are these :—

1. The rays from a single point of a distant object reach the eye, or the object glass of a telescope, parallel one to another.

2. Rays which were parallel one to another before reaching the objective of the telescope, cross each other in the second focal plane of the telescope.

3. Rays diverging from any point in the first focal plane of a lens are rendered parallel one to another after passing through the lens.

4. The ray passing through the middle point of a thin lens is undeviated.

Let O (Fig. 4) be the object glass of a telescope, and let AC, BC be two rays, derived respectively from the upper and lower extremities of a distant object, and passing through the middle point C of the object glass. The remaining rays from the upper

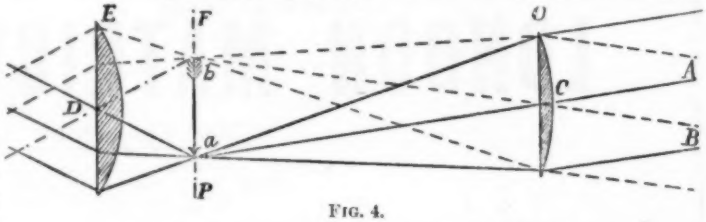

FIG. 4.

extremity of the object will reach O parallel to AC, and all these rays will cross at the point a where the ray AC produced cuts the second focal plane FP of the object glass. Similarly all rays from the lower extremity of the object will cross at the point b where the ray BC produced cuts the focal plane FP. Thus ab is the inverted image formed by the object glass.

The object subtends an angle ACB at the object glass, and since the length of the telescope will be small in comparison with the distance of the object, ACB or the equal angle aCb will give the angle subtended at the eye by the object. The circular measure of the angle is equal to ab/F, where F is the focal length of the object glass.

The eye-piece lens E is placed so that its first focal plane coincides with the plane of the image ab. If a ray aD from the point a fell on the middle point D of the eye-piece lens, this ray would remain undeviated. All the rays from a will be rendered parallel by their passage through E, and therefore all rays from a must leave E in a direction parallel to aD produced. Similarly all rays from b must leave E parallel to bD produced. Hence it is clear that the angle subtended at the eye by the image must be equal to the angle aDb, which is equal to ab/f in circular measure, f being the focal length of the eye-piece lense. Hence

$$\frac{\textit{Angle subtended at eye by image}}{\textit{Angle subtended at eye by object}} = \frac{\frac{ab}{f}}{\frac{ab}{F}} = \frac{F}{f}.$$

Strictly speaking, we ought to introduce a negative sign, since if the angle ACB is considered to be positive, the numerically equal angle aCb must be negative.

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CHEMISTRY

(ADVANCED AND HONOURS.)

BY C. A. WEST, B.SC., A.R.C.S., F.I.C.

Determination of Melting Points.—For the use of students taking practical chemistry, several methods of determining melting points of substances are here described. The method selected in any particular case will depend upon the nature of the substance and the quantity of it available.

In the case of a substance like paraffin wax, the substance may be melted in a test tube. The thermometer bulb is dipped into the liquid, and allowed to remain there for some little time, until it has acquired the temperature of the liquid. When it is removed it will be covered with a thin transparent film of molten paraffin. As the temperature falls the film solidifies and assumes a frosted or semi-transparent appearance.

If the bulb of the thermometer is small, so that the difference in the temperatures of the interior and exterior of the bulb may be neglected, the reading of the thermometer when this frosted appearance first shows itself may be taken approximately as the melting point of the wax. The error due to the difference in the inside and outside temperatures of the bulb may be made very small by making the temperature of the molten wax in the test tube near to the approximate melting point just obtained and repeating the determination. A further determination may be made by allowing the film on the bulb to solidify, and then placing the bulb in a beaker of water and slowly raising the temperature of the latter. The temperature at which the film becomes transparent is observed, and this may be taken as the melting point.

It is better, however, to take the mean of the two results obtained by the two methods. If water dissolves the substance, the film in the second method just described may be melted by bringing the bulb near to a heated body.

Another method frequently employed is to draw out a fine glass tube so that the bore is about one-sixteenth of an inch, and introduce into it a short column of the melted substance.

After solidification the small tube is attached to the side of the thermometer bulb by thread or rubber rings cut from small rubber tubing. It is then immersed in a beaker of water and the temperature raised until the substance is observed to fuse.

The temperature having been read, the experiment should be repeated with a fresh sample of the substance, and the temperature raised very slowly as the melting point is reached, to ensure the thermometer giving the correct reading.

If the substance has a higher melting point than 100° C., sulphuric acid may be used instead of water for the warming bath, but in this case the tube must not be attached to the thermometer by thread or rubber. A piece of fine platinum wire may be used instead, or if the bulb of the thermometer is cylindrical and not wider than the stem, it will be found that if the thermometer is wetted with the acid the tube will stick to the thermometer by itself if the tube is not completely immersed in the liquid, being held by capillarity.

In some cases it is difficult to tell the exact point of liquefaction, and in such cases it is a good plan to have only a small quantity of the substance near the lower end of the tube, so that the level of the top of the substance in the tube is below the level of the top of the liquid constituting the bath.

The liquid then tends to force the substance up the tube, and as soon as the melting point is reached the substance rises in the tube and the motion is readily seen.

For the latter experiment the substance may be introduced into the tube by dipping the end of the tube just below the surface of the molten substance, when a sufficient quantity will rise by the action of capillarity. In many cases, however, there is a distinct objection to melting the substance just before testing, as some substances (especially the animal fats) melt at a lower temperature when the fusion is repeated. The normal melting point is regained on allowing the substance to remain in the solid state for some time.

If the substance whose melting point is to be found is soluble in water or sulphuric acid, the substance should be placed in a tube closed at the lower end, as shown in the accompanying figure. In all cases the bath should be constantly stirred during the experiments, to ensure uniformity of temperature.

In addition to the methods already given, the melting point may be determined by what is known as the method of cooling. In this method the substance whose melting point is required is placed in a test tube or beaker and melted. A thermometer bulb is introduced into the middle of the liquid and the thermometer supported by a clamp. The source of heat is removed and the liquid allowed to cool. For accurate work it is also advisable to place the vessel in an enclosure of constant temperature. (A jar immersed nearly to the top in a large vessel of water serves very well.) It will be found that the cooling practically ceases at a certain point, or at any rate is greatly retarded. This point is the melting point.

The melting point is better obtained if, as the cooling takes place, the temperature is read every minute and the results set out on squared paper, using temperatures as ordinates and times as abscissæ. It will be found that one portion of the curve is a nearly horizontal line, and the mean temperature represented by this portion may be taken as the melting point. If the substance is of such a nature that there would be any danger of its breaking the thermometer bulb by contraction on solidification, the latter should be placed in a small metal sleeve or placed inside a glass tube filled with mercury.

If the substance is a metal or alloy with a low melting point, a suitable apparatus for holding the metal consists of two small cylindrical iron vessels, one inside the other, leaving an annular space between them into which the metal is introduced. Mercury is placed in the inner vessel, and the thermometer dips into this. The whole is heated up until the alloy is completely melted. The source of heat is then removed, and readings taken every minute as the cylinders and their contents cool.

Correction for the Projecting Thermometer Thread.—If, as is generally the case, the thread of the thermometer projects above the surface of the liquid, a correction must be applied to the melting point as determined by any of the above methods.

It will be evident that the readings given by the thermometer will be lower than they would be if the temperature of the projecting thread were raised to that of the bulb. Considering the effect on a length of the thread representing one degree, we see that the length of this expressed in terms of degree divisions on the stem would, if raised one degree, become greater by an amount 0·000143, this figure being the coefficient of apparent expansion of mercury in glass. If raised through $(T - t)$ degrees it would increase by an amount

$$(T - t) \times 0{\cdot}000143.$$

A length occupying N divisions on the stem if raised through $(T - t)$ degrees would increase in length by an amount equal to

$$N(T - t) \times 0{\cdot}000143.$$

Now we cannot tell what the temperature of the projecting thread is as it is not uniform, but we can get an approach to its average temperature by placing the bulb of a second thermometer midway between the surface of the bath and the top of the projecting thread and reading its temperature.

Let t represent the temperature read on this second thermometer and T the temperature as read on the first thermometer, then $(T - t)$ will represent approximately, but not exactly, the number of degrees through which the projecting thread would have to be raised in order to heat it up to the temperature of the bulb.

Hence if N represents the number of degree divisions occupied by the thread above the surface of the bath, then the correction to be added to the temperature reading given by the thermometer is

$$N(T - t) \times 0{\cdot}000143.$$

Although this method of correcting the readings gives only approximate results, it is found to be fairly satisfactory in practice, and gives much better results than applying no correction at all.

If the melting point is below 100° C., the correction is comparatively small, but in the case of a fairly high melting point it becomes a serious matter.

At a recent examination a number of students were asked to determine the melting point of a substance supplied. The greater number of the students gave the melting point several degrees too low, through not making a correction. As an illus-

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tration of the correction that should have been applied, the figures given by one student who made the correction will serve.

Melting point as read . .	197·5° C.
Mean temperature of thread .	70° C.
Number of degrees projecting	180
Correction to be added . .	$180(197-70)\times0{\cdot}000143$ $=180\times127\times0{\cdot}000143=3{\cdot}27$
Corrected temperature . .	$197{\cdot}5+3{\cdot}27$ $=200{\cdot}77$

The substance was anthracene, with a melting point of 201° C. For higher temperatures the correction becomes greater, and in the neighbourhood of 300° C. may be as much as 6 or 7 degrees.

PHYSIOGRAPHY.

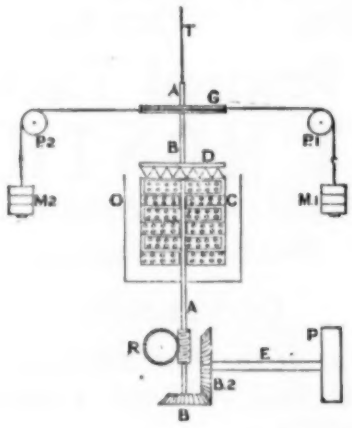
(STAGES 2 AND 3.)

ENERGY—(*continued*).

THE MECHANICAL EQUIVALENT OF HEAT—(*continued*).

THE accompanying figure shows diagrammatically the apparatus used by Rowland for determining the mechanical equivalent of heat.

A torsion wire T was suspended from a support and carried at its lower end a short shaft *a b*. To the upper end of this was attached a grooved pulley G, and to its lower end a wooden disc D. Suspended by cords from D was a calorimeter C. Fixed to the internal walls of the calorimeter were a number of vanes pierced with a large number of holes. Passing up through the bottom of the calorimeter was the shaft A, and attached to this



within the calorimeter was a second set of vanes, also pierced with holes, and capable of passing between the vanes attached to the walls of the calorimeter. During the experiments the calorimeter was of course nearly filled with water. The shaft A was continued some distance below the calorimeter, and carried a worm working into a toothed wheel R, which acted as a revolution counter. At the end of A was a bevel wheel B_1 gearing into another bevel wheel B_2. This latter was carried on a shaft E, which also carried a pulley P. When the apparatus was at work this pulley was driven by a belt from a steam-engine.

Around the calorimeter C was a second vessel O to diminish losses by radiation and air currents. Attached to the circumference of the grooved pulley G were two silk cords which left the pulley at the opposite ends of a diameter. These cords passed over pulleys p_1 and p_2, and supported equal weights M_1 and M_2.

Before the experiment was started, the water equivalent of the calorimeter was determined, and a known quantity of water introduced into the calorimeter. The pulley P was then set rotating, and its speed and the weights M_1 and M_2 adjusted until the weights were just supported.

When the shaft A with its paddles is rotated the water in the calorimeter is set in motion, and is forced against the stationary vanes on the walls of the calorimeter. This tends to make the calorimeter rotate, and it, when the speed is sufficiently great, does so through a small angle until the torsion on the wire T, together with the weights M_1 and M_2, just counterbalance the tendency. The sum of the couples due to the weights and the wire are the equal to the couple due to the energy imparted by the moving vanes to the water.

In order to make the calculation as simple as possible we will for the moment neglect the torsion on the wire, and suppose that all the opposition to the rotation of the calorimeter comes from the weights. The two couples are equal, and we should get just the same amount of heat produced if we kept the shaft A still and allowed the weights to fall and rotate the calorimeter, provided that the number of revolutions was the same. To calculate the energy given to the calorimeter, we may then calculate the energy which would be given up by the weights if they were thus allowed to fall. This would be given by the product of the mass (M_1+M_2), the force of gravity g, and the distance d fallen through, that is

$$(M_1+M_2)gd.$$

The distance d would be the circumference of the grooved pulley G multiplied by the number of revolutions made. This would be

$$d=2\pi r\times n,$$

where r is the radius of the pulley and n the number of revolutions.

If M_1 and M_2 are equal, we may represent them by $2M_1$, and the work done will then be expressed by

$$2M_1gd.$$

This equals

$$2n\pi 2M_1gr.$$

Now the couple C due to the wire acts in just the same way as the weights, and its effect will be $2n\pi C$. Hence the total amount of work done will be

$$2n\pi\,.\,2M_1gr+2n\pi C=2n\pi(2M_1gr+C).$$

The heat produced by means of this work is given by the product of the temperature rise into the sum of the weight of the water and the water equivalent of the calorimeter. Suppose the heat produced is represented by H, then we can write the equation

$$H=2n\pi(2M_1gr+C).$$

Hence one unit of heat corresponds to

$$\frac{2n\pi(2M_1gr+C)}{H}\text{ units of work,}$$

and this therefore represents J.

The advantages of Rowland's method of determining J were—

(1) The rise in temperature was comparatively great, being about three-quarters of a degree per minute.
(2) The weights did not actually fall, and therefore there was no correction to make for the heat lost by the impact of the weights on the floor.
(3) The experiment could be continued for a considerable time, and the total rise in temperature made large.
(4) As the rise in temperature was rapid, the correction for loss by radiation was not great.
(5) Rowland redetermined the specific heat of water, instead of accepting Regnault's figures, and showed that it had a minimum at about 29° C.

He corrected his results for this.

The result obtained by Rowland as the value for J was 427·52 kilogrammetres per calorie.

In order to compare this with Joule's result, Rowland standardised the thermometer used by Joule by comparing it with the air thermometer. Expressing Joule's results in the same units as those employed by Rowland, this is 426·75, a result somewhat lower than Rowland's.

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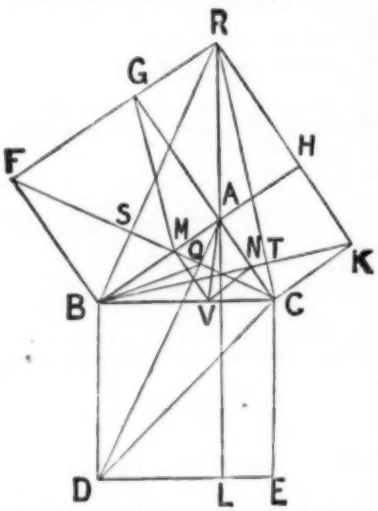
S.R.—In the figure of Euclid I. 47 prove that:—

(*a*) BQ bisects the angle FQD;
(*b*) LA, FG, KH meet in a point;
(*c*) AL, BK, CF meet in a point;
(*d*) if FC meets AB in M, and KB meets AC in N, then AM = AN.

(Marshall's *School and College Euclid.*)

(*a*) By Euclid I. 4 the angle FCB is equal to the angle ADB. Hence B, Q, C, and D are concyclic. Therefore the angle DQC is equal to the angle DBC, and the angle BQD to the angle BCD. But DBC is a right angle, and BCD is half a right angle. Hence BQ bisects the angle FQD.



(*b*) Let FG, KH meet in R. Join AR.

By Euclid I. 4 the angle RAH is equal to the angle BCA. By construction, AL is perpendicular to BC, hence the angles BCA, LAC are together equal to a right angle. Therefore RAH, LAC are together equal to a right angle. Also HAC is a right angle. Therefore AR is in the same straight line with LA. Hence LA, FG, KH meet in a point.

(*c*) Join RB, RC cutting CF, BK in S, T.

Because AR = BC = BD, and AR is parallel to BD, therefore BR is parallel to DA. Hence the angle FSB is equal to the angle SQD. But it was shown under (*a*) that SQD is a right angle. Therefore CF is perpendicular to BR.

Similarly, BK may be shown to be perpendicular to CR. And, by construction, RL is perpendicular to BC.

Thus RL, BK, CF are perpendiculars drawn from the vertices of the triangle RBC to the opposite sides. Hence, by a well-known theorem, RL, BK, CF meet in a point.

(*d*) Through M draw MV parallel to AC, and meeting BC in V. Join AV and MG.

By Euclid I. 37 the triangle MAV is equal to the triangle MCV. Add to each the triangle BMV. Therefore the triangle BMC is equal to the triangle BVA.

The triangles FMB, GMA are together equal to half the square FA. But the triangle FCB is equal to half the square FA. Hence the triangle GMA is equal to the triangle BMC. But the triangle BMC is equal to the triangle BVA. Therefore the triangle GMA is equal to the triangle BVA. But these triangles are upon the equal bases AG, AB, and each of the angles GAM, AMV is a right angle; therefore the altitude AM is equal to the altitude MV.

Because AMV is a right angle and MA is equal to MV, therefore MAV is half a right angle. Hence AV bisects the angle BAC.

Therefore, if a line AV be drawn bisecting the angle BAC and meeting BC in V, and MV be joined, then AV is the diagonal of a square of which VM, MA are adjacent sides.

Similarly, if VN be joined, it may be shown that AV is the diagonal of a square of which VN, NA are adjacent sides.

Hence AMVN is a square, and therefore AM is equal to AN.

A Beckett.—Eliminate θ and ϕ from the equations—

$$\cos\theta+\cos\phi=a \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

$$\operatorname{cotan}\theta+\operatorname{cotan}\phi=b \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

$$\operatorname{cosec}\theta+\operatorname{cosec}\phi=c \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

(Stage 3, 1887.)

From (1) we have

$$\cos\frac{\theta+\phi}{2}\cdot\cos\frac{\theta-\phi}{2}=\frac{a}{2} \quad . \quad . \quad . \quad . \quad . \quad (4)$$

From (2) we have

$$\frac{\cos\theta}{\sin\theta}+\frac{\cos\phi}{\sin\phi}=b.$$

$$\therefore\ \sin\theta\cos\phi+\cos\theta\sin\phi=b\sin\theta\sin\phi.$$

$$\therefore\ \sin(\theta+\phi)=b\sin\theta\sin\phi \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (5)$$

From (3) we have

$$\frac{1}{\sin\theta}+\frac{1}{\sin\phi}=c.$$

$$\therefore\ \sin\theta+\sin\phi=c\sin\theta\sin\phi \quad . \quad . \quad . \quad . \quad . \quad (6)$$

Dividing (5) by (6) we have

$$\frac{\sin(\theta+\phi)}{\sin\theta+\sin\phi}=\frac{b}{c}.$$

$$\therefore\ \frac{2\sin\frac{\theta+\phi}{2}\cos\frac{\theta+\phi}{2}}{2\sin\frac{\theta+\phi}{2}\cos\frac{\theta-\phi}{2}}=\frac{b}{c}.$$

$$\therefore\ \frac{\cos\frac{\theta+\phi}{2}}{\cos\frac{\theta-\phi}{2}}=\frac{b}{c} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (7)$$

Multiplying (4) by (7) we have

$$\cos^2\frac{\theta+\phi}{2}=\frac{ab}{2c} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (8)$$

Dividing (4) by (7) we have

$$\cos^2\frac{\theta-\phi}{2}=\frac{ca}{2b} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (9)$$

From (6) and (5) we have on squaring and subtracting,

$$(c^2-b^2)\sin^2\theta\sin^2\phi=4\sin^2\frac{\theta+\phi}{2}\left(\cos^2\frac{\theta-\phi}{2}-\cos^2\frac{\theta+\phi}{2}\right);$$

$$\therefore\ (c^2-b^2)\sin^2\theta\sin^2\phi=4\left(1-\cos^2\frac{\theta+\phi}{2}\right)\left(\cos^2\frac{\theta-\phi}{2}-\cos^2\frac{\theta+\phi}{2}\right)$$

$$\therefore\ (c^2-b^2)\sin^2\theta\sin^2\phi=4\left(1-\frac{ab}{2c}\right)\left(\frac{ca}{2b}-\frac{ab}{2c}\right);$$

$$\therefore\ (c^2-b^2)\sin^2\theta\sin^2\phi=\frac{(2c-ab)(c^2-b^2)\cdot a}{bc^2};$$

$$\therefore\ \sin^2\theta\sin^2\phi=\frac{a(2c-ab)}{bc^2};$$

$$\therefore\ \frac{1}{4}\left\{\cos(\theta-\phi)-\cos(\theta+\phi)\right\}^2=\frac{a(2c-ab)}{bc^2};$$

$$\therefore\ \left\{2\cos^2\frac{\theta-\phi}{2}-1-2\cos^2\frac{\theta+\phi}{2}+1\right\}^2=\frac{4a(2c-ab)}{bc^2};$$

$$\therefore\ \left\{\frac{ca}{b}-1-\frac{ab}{c}+1\right\}^2=\frac{4a(2c-ab)}{bc^2};$$

$$\therefore\ \frac{a^2(c^2-b^2)^2}{b^2c^2}=\frac{4a(2c-ab)}{bc^2};$$

$$\therefore\ a(c^2-b^2)^2=4b(2c-ab);$$

$$\therefore\ 4ab^2+a(c^2-b^2)^2-8bc=0.$$

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The Anglo-Russian. Edited by Jaakoff Prelooker. Vol. X. Nos. 1–4. This journal is doing a good work in arousing the sympathy of Englishmen for the misgoverned people of Russia. We notice as a part of its programme that it "aspires to the attainment of just laws for both sexes alike." This is a noble aspiration, which, we admit, is open to the argument that such an ideal cannot be attained in its entirety until the suffrage is granted to women. It seems to us, however, a pity that while Englishmen are practically united in wishing to see Russia obtain constitutional government, but divided on the question of granting the suffrage to women, a paper which, to judge from its title, exists to focus the moral force of English opinion in favour of downtrodden Russia, should advocate claims which the majority of women do not make for themselves, and about granting which the majority of men are not convinced. We hold no brief either for the feminists or the anti-feminists; but the way in which women's claims are advocated in this journal is neither temperate, just to opponents, nor in good taste. Thus we read, "When a member of the Cabinet escapes by his backdoor rather than face three earnest logical women suffragists, he gives away his case so completely that contemptuous pity for his poltroonery is equally excited with the sympathy expressed for the victims he was instrumental in unjustly imprisoning." Again, "We have only to study as physiognomists on scientific lines the faces of the opponents to the women movement to gauge how low down in the evolutionary scale of the true human they really are." That is strong, but a third extract runs it pretty close. "That is why the sensual majority defer the fateful day of liberty to women. We are fighting the powers of evil, and men know it." It may be owing to the introduction of such intemperate utterances as those we have quoted that this journal enjoys only a very limited circulation.

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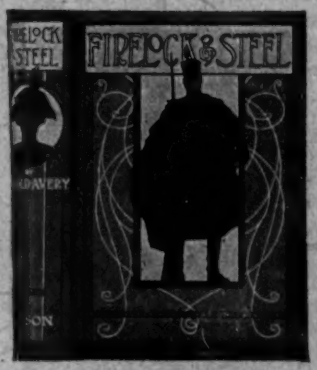

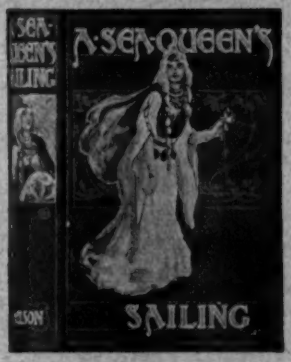

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